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# **SWATER**RESOURCES ABSTRACTS



VOLUME 7, NUMBER 7 APRIL 1, 1974 SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

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# SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior



VOLUME 7, NUMBER 7 APRIL 1, 1974

W74-03201 -- W74-03750

The Secretary of the U. S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

### FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the Water Resources Thesaurus. Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCU-MENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center Office of Water Resources Research U.S. Department of the Interior Washington, D. C. 20240

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ABSTRACT SOURCES

### SELECTED WATER RESOURCES ABSTRACTS

### 01. NATURE OF WATER

### 1A. Properties

HYDROGEN-BOND PATTERNS IN LIQUID WATER,

onne National Lab., Ill. Argonne National Lab., Ill.

A. Rahman, and F. H. Stillinger. No 24, p 7943-7948, November 28, 1973. 7 fig, 2 tab, 19 ref.

Descriptors: \*Water properties, \*Water structure, \*Hydrogen bonding, \*Molecular structure, \*Crystallography, \*Water chemistry, Hydrates, Ice, Simulation analysis, Thermodynamics, Crystals.

Theoretical distributions of non-short-circuited hydrogen-bond polygons between water molecules have been constructed, using a set of 14 configura-tions generated by a molecular dynamics simula-tion for liquid water. The thermodynamic state analyzed has a temperature of 10 C and a mass density of 1 g/cu cm. The distributions are broad and show nontrivial contributions from polygons with sizes greater than 8. These results seem to be inconsistent with the view of liquid water as a recognizable disrupted version of any known ice or hydrate crystal structure. (Brown-IPC)

### 1B. Aqueous Solutions and Suspensions

COMPARISON OF FIELD AND SIGMA-INDU-CTIVE MODELS FOR THE TRANSMISSION OF NONCONJUGATIVE SUBSTITUENT EFFECTS. THE 2,6-SPIRO (3,3) HEPTYL SYSTEM Georgia Inst. of Tech. Atlanta. School of Chemis-For primary bibliographic entry see Field 02K.

OF THERMODYNAMICS ACID-BASE EQUILIBRIA. M' AND P' HYDROXYBENZAL-DEHYDE.

Georgia Inst. of Tech. Atlanta. School of Chemis-For primary bibliographic entry see Field 02K. W74-03738

ANOMALOUS HEAT CAPACITIES OF SUPER-COOLED WATER AND HEAVY WATER, Cryobiology Research Inst. Madison, Wis. D. H. Rasmussen, A. P. MacKenzie, C. A. Angell, and J. C. Tucker.

Science, Vol. 181, p 342-344, 1973, 1 fig, 1 tab, 13 ref. OWRR B-051-IND (2).

Descriptors: \*Supercooling, \*Water structure, \*Thermal capacity, \*Emulsion, \*Nucleation, \*Heavy water, Water chemistry, Water properties, Heat capacity, Temperature, Rainfall nuclei, Crystallization, Deuterium.

Identifiers: Calarimetric, Resonance, Dilatometric. Proton Magnetic

Emulsification makes it possible to supercool water to the homogeneous nucleation temperature. Accordingly, the heat capacities of water and deuterium oxide have been determined from the respective equilibrium melting points to -38 and to -34C, respectively. Two methods, drift calorimetry and differential scanning calorimetry, have been used. Both methods reveal a striking rise in the constant-pressure heat capacity below-20C. This indication of an apparently cooperative behavior should serve to test current theories of water, most notably perhaps, the pair potential model of Ben-Naim and Stillinger. Some implications of possible meteorological significance are W74-03740

GLASS TRANSITION WITH NEGATIVE CHANGE IN EXPANSION COEFFICIENT, Purdue Univ., Lafayette, Ind. Dept. of Chemistry. E. Williams, and C. A. Angell. Journal of Polymer Chemistry, Polymer Letters Edition, Vol 11, p 383-387, 1973. 2 fig, 16 ref. OWRR B-051-IND (3).

Descriptors: \*Aqueous solutions, \*Polymers, Pescriptors: Aqueous solutions, Folymers, Physical properties, Thermal properties, Thermal expansion, Enthalpy, Entropy, Thermodynamic behavior, Thermal capacity, Heat capacity, Differential thermal analysis. Identifiers: \*Coefficient of expansion, Glass transition temperature, Configuration excitation, Differential scanning calorimetry.

The factor which controls viscous flow in liquid polymers and polymer solutions is the unoccup or 'free' volume within the liquid structure. This quantity can be assessed through an empirical relationship from a knowledge of the change in the expansion coefficient at the glass transition tempera-ture and the temperature interval from the transition point to the temperature of interest. However, accurate indirect evidence, and less accurate but supporting evidence is presented showing that for a lithium acetate water system a negative value for the difference between the expansion coefficients of the liquid and the glass transition temperature exists. These findings provide strong evidence for entropy, enthalpy, or configuration excitation s over free volume theories. Volume theories work as well as they do for polymeric liquids and many small molecule van der Waals liquids, only because for these cases liquid volume is closely correlated with enthalpy. (Wiersma-Indi-W74-03741

### 02. WATER CYCLE

### 2A. General

FIFTH ALL-UNION SYMPOSIUM ON GLACIOLOGY (O PYATOM OBSHCHESOYUZ-NOM GLYATSIOLOGICHESKOM SIMPOZI-UME).

Akademiya Nauk SSSR, Moscow. Institut Geografii. For primary bibliographic entry see Field 02C.

W74-03260

LIMESTONE SPRINGS AND INDIVIDUAL FLOOD EVENTS, (WITH SPECIAL REFERENCE TO THE GOWER PENINSULA,

University Coll. of Swansea (Wales). Dept. of Geography.

For primary bibliographic entry see Field 02F. W74-03512

THE WATER CYCLE ON A WATERSHED IN THE PALOUSE REGION OF IDAHO, Bureau of Reclamation, Fresno, Calif. For primary bibliographic entry see Field 04A. W74-03739

### 2B. Precipitation

SOME DATA ON FLUORINE, BROMINE, AND IODINE CONCENTRATIONS IN ATMOSPHER-IC PRECIPITATION AT VORONEZH (NEKO- TORYYE DANNYYE O SODERZHANII FTORA. BROMA I IODA V ATMOSFERNYKH OSAD-KAKH G. VORONEZHA), Voronezhakii Lesotekhnicheskii Institut (USSR). For primary bibliographic entry see Field 05A.

STATISTICAL PREDICTION OF EQUILIBRI-UM TEMPERATURE FROM STANDARD METEOROLOGICAL DATA BASES, ESL, Inc., Sunnyvale, Calif.
For primary bibliographic entry see Field 05A.

W74-03330

DESIGN OF OPTIMAL PRECIPITATION NET-WORKS,

Massachusetts Inst. of Tech., Cambridge, Ralph M. Parsons Lab. for Water Resources and

W. M. Grayman, and P. S. Eagleson. Available from the National Technical Information Service as PB-227 221, \$4.75 in paper copy, \$1.45 in microfiche. Report No. 168, 1973. 124 p,

28 fig, 5 tab, 25 ref, 3 append. OWRR C-2137 (No

Descriptors: Precipitation (Atmospheric), Rain gages, Precipitation gages, Depth-area-duration analysis, \*Simulated rainfall, \*Network design, Model studies, Radar, \*Warning systems, \*Optimization, Costs, Benefits, Simulation analysis, Measurement, Income.

Identifiers: \*Precipitation network, Susquehanna River.

The design of a precipitation measuring network based on the cost of the network and the benefits derived from the measurements is demonstrated. A single objective, maximize net national income and a single purpose use of the measurements in a flood warning system form the basis for the analy-sis. Two models are developed to determine the net benefits resulting from a particular network design. One model is a simulation model in which a trace of floods is generated, the error in flood prediction as a result of precipitation measurements is simulated and the net benefits are calculated. A second model is based on the convolution of probability distributions to determine the expected value of net benefits. A case study is performed in which the expected value model is utilized to determine the optimal precipitation measuring system for a river basin based on data representing the West Branch of the Susquehanna River. This study indicates the importance of considering network accuracy in the design of the network and in determination of the feasibility of a flood warning system. (Schaake-MIT) W74-03333

A MULTISPECTRAL STUDY OF AN EXTRATROPICAL CYCLONE WITH NIMBUS 3 MEDIUM RESOL RADIOMETER DATA, RESOLUTION INFRARED

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

R. Holub, and W. E. Shenk. Available from NTIS, Springfield, Va 22151, NASA TN D-7184, Price \$3.00 printed copy (\$6.00 foreign) \$1.45 microfiche. National Aeronautics and Space Administration Technical Note D-7184, November 1973. 71 p, 23 fig, 1 tab, 30 ref, append.

Descriptors: \*Remote sensing, \*Cyclones, \*Weather patterns, \*Infrared radiation, \*Meterological data, Analytical techniques, Storms, Mapping, Tracking techniques, Cloud physics, Correlation analysis, Data collections, Aircraft, Ships, Satellites (Artificial). Identifiers: Extratropical cyclones, Satellite radia

tion data, Cloud-type identification.

### Group 2B-Precipitation

Four registered channels (0.2 to 4, 6.5 to 7, 10 to 11, and 20 to 23 micrometers) of the Nimbus 3 Medium Resolution Infrared Radiometer (MRIR) were used to study 24-hr changes in the structure of an extratropical cycline during a 6-day period in May 1969. Use of a stereographic-horizon map projection insured that the storm was mapped with a single perspective throughout the series and allowed the convenient preparation of 24-hr dif-ference maps of the infrared radiation fields. Single-channel and multispectral analysis techniques ere employed to establish the positions and vertical slopes of jetstreams, large cloud systems, and major features of middle and upper tropospheric circulation. Use of these techniques plus the dif-ference maps and continuity of observation allowed the early detection of secondary cyclones developing within the circulation of the primary cyclone. An automated, multispectral cloud-type identification technique was developed, and comparisons that were made with conventional ship reimage dissector camera system (IDCS) showed good agreement. (Woodard-USGS) W74-03349

A STUDY OF BIOTROPISM OF CLIMATE IN WO CANADIAN CITIES, Meteorological Office, Poona (India). For primary bibliographic entry see Field 05C. W74-03478

THE METEOROLOGICAL EFFECTS ON MICROWAVE APPARENT TEMPERATURES LOOKING DOWNWARD OVER A SMOOTH

Kansas Univ./Center for Research, Inc., Lawrence.

For primary bibliographic entry see Field 07B. W74-03511

INVESTIGATION OF THE CHEMICAL COM-POSITION OF ATMOSPHERIC PRECIPITA-TION IN THE VICINITY OF YEVPATORIYA ISSLEDOVANIYE KHIMICHESKOGO SOSTAVA ATMOSFERNYKH OSADKOV V RAYONE G. YEVPATORII), For primary bibliographic entry see Field 02K.

W74-03526

### 2C. Snow, Ice, and Frost

FIFTH ALL-UNION SYMPOSIUM ON GLACIOLOGY (O PYATOM OBSHCHESOYUZ-NOM GLYATSIOLOGICHESKOM SIMPOZI-

Akademiya Nauk SSSR, Moscow. Institut Geografii.

G. A. Avsyuk, and V. M. Kotlyakov. Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 3, p 147-148, May-June

Descriptors: \*Conferences, \*Glaciology, Glaciation, Glaciers, Mountains, \*Ice, \*Snowpacks, Avalanches, Movement, Runoff, Water balance, Heat balance, Antarctic, Satellites (Artificial).
Identifiers: USSR, Paleoglaciology, Ice lenses,

Organized by the Interdepartmental Committee on Geophysics and by the Central Asian Regional Hydrometeorological Institute of the Main Administration of the Hydrometeorological Service, the Fifth All-Union Symposium on Glaciology was held in Tashkent, September 25-October 8, 1972. Participants included about 225 scientists from the Academy of Sciences of the USSR and Union Republics, institutes of the Hydrometeorological Service, and a number of universities and planning and industrial organizations. The 114 papers presented at 8 plenary and 14 working sessions were grouped under 9 subject headings: complex investigations of glaciers and glacierized areas (21 papers); glaciohydroclimatology and glacier runoff (19 papers); movement and tectonic structure of glaciers (8 papers); physical methods of investigation (7 papers); glaciology of the Antarctic (6 papers); paleoglaciology (15 papers); seasonal snow cover (11 papers); snow avalanches (20 papers); and ice lenses, sea ice, and river ice (7 papers). Results of investigations of ice, water, and heat balances in glacier basins of the Altay, Caucasus, Tien Shan, Pamir, and Alay Mountains were summarized, and consideration was given to possibilities of using artificial earth satellites to study snow-glacier complexes in mountains.

Proceedings of the Fifth Symposium will be published in Transactions of the Central Asian Regional Hydrometeorological Institute and in the collections 'Data of Glaciological Studies; Chronicle and Discussions,' to be published by the USSR Academy of Science's Institute of Geography (Nos. 21-23). The Sixth All-Union Symposium on Glaciology is scheduled to be held in Alma-Ata in September 1976. (Josefson-USGS) W74-03260

SOME ARCTIC LIMNOLOGY AND THE HIBERNATION OF INVERTEBRATES AND SOME FISHES IN SUB-ZERO TEMPERA-TURES.

Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology. For primary bibliographic entry see Field 02H. W74-03275

MINERALIZATION AND IONIC COMPOSI-TION OF ICE IN SOME WATER BODIES OF THE NORTHERN CAUCASUS (O REZHIME MINERALIZATSII I IONNOGO SOSTAVA L'DA NEKOTORYKH VODOYEMOV SEVERNOGO KAVKAZA), Gidrokhimicheskii

Institut. Novocherkassk (USSR). For primary bibliographic entry see Field 02K. W74-03529

### 2D. Evaporation and Transpiration

STATISTICAL PREDICTION OF EQUILIBRI-UM TEMPERATURE FROM STANDARD METEOROLOGICAL DATA BASES, ESL, Inc., Sunnyvale, Calif.
For primary bibliographic entry see Field 05A.

W74-03330

USE OF FINITE-DIFFERENCE ARRAYS OF OBSERVATION WELLS TO ESTIMATE EVAPOTRANSPIRATION FROM GROUND WATER IN THE ARKANSAS RIVER VALLEY, COLORADO,

Geological Survey, Washington, D.C. E. P. Weeks, and M. L. Sorey. Water-Supply Paper 2029-C, 1973. 27 p, 8 fig, 3

Descriptors: \*Evapotranspiration, \*Ground water, \*Flood plains, \*Colorado, Observation wells, Data collections, Methodology, Regression analysis, Vegetation, Growth rates, Correlation analysis, Water level fluctuations, Forecasting, Evaluation. Identifiers: \*Arkansas River Valley (Colo.).

A method to determine evapotranspiration from ground water was tested at four sites in the flood plain of the Arkansas River in Colorado. Approximate ground water budgets were obtained by analyzing water-level data from observation wells installed in five-point arrays. The analyses were based on finite-difference approximations of the differential equation describing ground water flow. Data from the sites were divided into two groups by season. It was assumed that water levels during the dormant season were unaffected by evapotranpsiration of ground water or by recharge, collectively termed 'accretion.' Regres-sion analyses of these data were made to provide an equation for separating the effects of changes in aquifer storage and of aquifer heterogeneity from those due to accretion during the growing season. The data collected during the growing season were thus analyzed to determine accretion. Reasonable estimates of total and ground water evapotranspiration were obtained at the Las Animas and Lamar sites. Moreover, results from animas and Lamar sites. Moreover, results from different years for these sites were in good agree-ment, and the seasonal distribution of computed monthly evapotranspiration generally followed the expected pattern. Analysis of the winter data from these sites provided estimates of hydraulic con-ductivity in good executativity. ductivity in good agreement with those determined from aquifer tests at nearby wells. (Woodard-W74-03508

IMMEDIATE RESUMPTION OF GROWTH BY RADIATA PINE AFTER FIVE MONTHS OF MINIMAL TRANSPIRATION DURING DROUGHT

Commonwealth Forestry and Timber Bureau, Canberra (Australia).

K. W. Cremer.

Aust For Res. Vol 6, No 1, p 11-16. 1972. Illus. Identifiers: Drought, Growth, Minimal, Moisture, \*Pine trees, Pinus-Radiata, Rain, Resumption, Soil, Tension, \*Transpiration, \*Australia.

Rooted cuttings of radiata pine (Pinus radiata D. Don) were grown in the open at Canberra, Australia to heights of about 75 cm in drained containers holding 25 1 of soil. Four containers were watered to excess on 26 Feb. 1969, and their upper parts covered so as to exclude rain from the soil while still permitting ventilation of the soil and leaving the foliage exposed. After the free water had drained off, the average rate of transpiration, as gauged by the loss of weight of the covered conas gauged by the loss of weight of the covered containers, declined from 400 g/day during the first wk to 4 g/day after 10 wk, and remained at or below this rate during the trmsininh 20 wk of soil drought. When rewatered after 30 wk, 3 of the plants resumed height growth within 1 day, but the 4th died. From subsequent determinations of dry weights and of the relationship between soil moisture content and soil moisture tension (established with pressure membrane apparatus) it was estimated that during the 20 wk of very slow transpiration the average soil moisture content fell from 9.2-7.3% and the average soil moisture ten-sion increased from 5.5-17.9 bars.--Copyright 1973, Biological Abstracts, Inc. W74-03519

THE SIGNIFICANCE OF THE FALLOW YEAR IN THE DRY-FARMING SYSTEM OF THE GREAT KONYA BASIN, TURKEY,

Agricultural Univ., Wageningen (Netherlands).
Dept. of Soils and Fertilizers. For primary bibliographic entry see Field 03F. W74-03605

A PRACTICAL METHOD OF CALCULATING POTENTIAL EVAPOTRANSPIRATION, (IN FRENCH),

P. Brochet, and N. Gerbier. Ann Agron (Paris). Vol 23, No 1, p 31-49. 1972, Il-

lus. (English summary).
Identifiers: \*Evapotranspiration, \*Evaporimeters (Pich), Radiation, Transpiration, Measurement.

The calculation of potential evapotranspiration from the expression of the energy balance drawn up by Penman, led to a formula in which the only weather parameters involved are global radiation and the evaporation measured under shelter by means of the Pich evaporometer.—Copyright 1973, Biological Abstracts, Inc. W74-03721

### 2E. Streamflow and Runoff

RESPONSE OF THE LOWER MISSISSIPPI RIVER TO CHANGES IN VALLEY SLOPE, SINUOSITY AND WATER TEMPERATURE, Army Engineer District, Vicksburg, Miss.

L. G. Robbins. In: Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, p 39-48, 1973. 5 fig, 10 ref.

Descriptors: \*Streamflow, \*Channel morphology, \*Sediment transport, \*Mississippi River, \*Mississippi, Correlation analysis, Environmental effects, Water temperature, S rates, Navigation. Identifiers: Valley slope. temperature, Slopes, Meanders, Flow

The Potamology Section, Vicksburg District, Corps of Engineers, has been studying the varia-bles influencing the morphology of the Lower Mississippi River. Three of these variables are valley slope, sinuosity, and water temperature. The similarity of valley slope and sinuosity curves and the agreement between the field and laboratory investigations support the contention that among other variables, the slope of the valley floor upon which a river flows strongly influences its pattern.
The investigations on the effects that the seasonal water temperature variation has on the stagedischarge relationship, sediment transport and bed roughness exemplify the importance of recogniz-ing the close interrelationship that exists between the various parameters. This interaction of varia-bles could be of extreme practical significance in rivers where it is necessary to not only predict the sediment transport, but also to predict the unobstructed depths available for navigation. (See also W74-03212) (Woodard-USGS)

INVESTIGATION OF RUNOFF OF KAMCHAT-KA RIVERS BASED ON CLIMATIC DATA (ISS-LEDOVANIYE STOKA REK KAMACHATKI PO KLIMATICHESKIM DANNYM), Adademiya Nauk SSSR, Moscow. Institut

Geografii.

L. S. Potapova

Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 3, p 88-94, May-June 1973. 2 fig, 2 tab, 14 ref.

Descriptors: \*Runoff, \*Rivers, \*Climatic data, Water balance, Precipitation (Atmospheric), Water balance, Precipitation (Atmospheric), Evaporation, Water storage, Heat balance, Runoff coefficient, Equations, Maps. Identifiers: \*USSR (Kamchatka).

A map of annual runoff, in depth in mm, for Kamchatka was constructed and refined from water and heat balances, based on long-term average monthly data of 52 meteorological and hydrologic stations. Runoff for the peninsula is highest on windward slopes in the southeast (800-1,000 mm/yr). Runoff is less on the west coast (200-400 mm/yr). Low runoff, resulting from low precipitation, was also recorded in intermontane valleys of Kamchatka rivers (100-200 mm/yr). valleys of Kamchatka rivers (100-200 mm/yr). With increasing piedmont elevation on the Central Stredinnyy khrebet) and Eastern Ranges, runoff increases to 400-600 mm/yr. Runoff coefficients in the Kamchatka River valley are 25%-55%, on the west coast--30%-65%, and on the east coast--50%-80%. (Josefson-USGS) W74-03259

EAGLE EYE - NEW FLOWMETER, Dieterich Standard Corp., Boulder, Colo. Ellison For primary bibliographic entry see Field 07B.
W74-03290

AN INEXPENSIVE, FAST RESPONSE CUR-RENT SPEED INDICATOR, Virginia Inst. of Marine Science, Gloucester Point.

For primary bibliographic entry see Field 07B. W74-03310

MAXIMUM BREAKER HEIGHT FOR DESIGN, Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 08B. W74-03363

THE RELATIONSHIPS BETWEEN WIND RECORDS, ENERGY OF LONGSHORE DRIFT, AND ENERGY BALANCE OFF THE COAST OF A RESTRICTED BODY OF WATER, AS AP-PLIED TO THE BALTIC,

Kiel Univ. (West Germany). Geologisch-Palaeon-tologisches Institut und Museum. For primary bibliographic entry see Field 02J. W74-03431

WAVE SET-UP ON A BEACH, Royal Netherlands Meteorological Inst., De Bilt. R. Dorrestein.

In: Proceedings of the Second Technical Conference on Hurricanes, June 1961, held Miami Beach, Florida. U.S. Weather Bureau, National Hurricane Research Project, Report No 50 Part 1, p 230-241, March 1962. 3 fig, 1 tab, 6 ref, 1 append.

Descriptors: \*Beaches, \*Waves (Water), \*Florida, \*Shallow water, Deep water, \*Coasts, Ocean

Identifiers: Wave set-up, Breaking waves, Wave properties.

Wave set-up is defined as the difference between the water level near the shore line when waves are running toward the coast, and the corresponding average level in deeper water. Fairchild (1958) and Saville, Jr. (1961) are referred to for results of model observations of wave set-up on a beach. Some field observations made at the fishing pier at Fernandina Beach on the Atlantic Coast of Florida are described, and the results are used to check the validity of a simplified theory relating the wave set-up to the wave properties in relatively deep water. The methodology and instrumentation which included motion pictures are described and the location of observation points at the pier is shown in a graph. The wave set-up and run-up on the beach were observed by means of 4-6 transparent, plastic tubes. A sample from the time histories of the water elevations at the plastic tubes, according to the motion pictures, for one of the observations is given in a graph. A derivation of the theoretical equation for the wave set-up is presented. The results of the field observations which are summarized in a table and afford an approximate check of the theoretical equation are discussed. It is noted that the theoretical values tend to be too low. Eleven of the possible reasons for the discrepancies are listed and discussed. It is concluded that the theory is in fair agreement with the observations but that the accuracy of both the theory and the observations can be improved. Simplifying assumptions made in applying the theory are listed in an Appendix. (Sinha - OEIS) W74-03432

### SERIES SOLUTIONS FOR SHALLOW WATER

WAVES, California Univ., Berkeley. E. V. Laitone.

Journal of Geophysical Research, Vol 70, No 4, p 995-998, February 15, 1965. 9 ref.

Descriptors: \*Shallow water, \*Waves (Water), Numerical analysis. Identifiers: Water depth, Cnoidal waves

The purpose is to convert the second order terms for finite amplitude cnoidal waves from their reference depth based upon the water depth below the wave trough to the more appropriate expres-sion in terms of the mean or still water depth. (Sinha-OEIS)

W74-03440

THE SPECTRAL STRUCTURE OF WAVES IN THE NEARSHORE ZONE,

For primary bibliographic entry see Field 02L. W74-03448

THE GENERATION OF EDGE WAVES BY CYLINDRICAL WAVES IMPINGING FROM THE OUTER SEA, Tohoku Univ., Sendai (Japan). Geophysical Inst.

Tohoku University Science Reports, 5th Series, Geophysics, Vol 14, No 1, p 27-40, April 1962. 11 fig, 1 tab, 8 ref.

Descriptors: \*Waves (Water), Tsunamis, \*Coasts. Identifiers: \*Edge waves, \*Wave energy.

The problem of generation of edge waves due to long waves impinging upon a continental shelf from the outer sea is investigated. A line source with an aperiodic time-dependence is assumed. The Coriolis force is omitted. A theoretical marigram at a coastal station with a large longshore distance from the source is computed. Excitation of the edge waves is governed by the depth ratio between the outer sea and the shelf, the size of the shelf, the offshore distance of the wave source, and the spectrum of the primary wave. The results may explain some observed features of the edge waves due to a tsunami. (Sinha-OEIS) W74-03451

### FEATURES OF HORIZONTAL TURBULENCE IN THE LITTORAL ZONE OF THE OCEAN, Institute of Biology of the Southern Seas, Odessa

(USSR) D. M. Tolmazin.

Atmospheric and Oceanic Physics Series Vol 8, No 3, p 194-196, October 1972. 3 fig, 14 ref. (American Geophysical Union). Trans. from the Russian.

Descriptors: \*Littoral, \*Turbulence, Coasts, \*Diffusion, Energy, Oceans.
Identifiers: Nearshore, Horizontal turbulence.

Previous work relating to various features of horizontal turbulence in the littoral zone of the ocean is reviewed. The morphological disturbances responsible for the existence of external turbulence scales on the order of hundreds of meters cause the diffusing admixture near the shore to pass rapidly through the inertial-subrange and dissipate in the regime of Brownian motion. This explains why the exponent in the expression describing the diffusion coefficient K as a function describing the diffusion coefficient K as a function of the scale 1 of the phenomenon was always smaller than 4/3, with K almost independent of 1 in certain cases. With diffusion so clearly predominant in the Brownian-motion regime, K is now no longer related to the rate of turbulent-energy dissipation, but instead to the intensity of the turbu-lent motion. (Sinha-OEIS) W74-03452

## COASTAL SURFACE CURRENTS AROUND NEW ZEALAND, Department of Scientific and Industrial Research,

Wellington (New Zealand). Oceanographic Inst.

New Zealand Journal of Geology and Geophysics, Vol 3, No 2, p 235-252, May 1960. 7 fig, 3 tab, 24

Descriptors: \*Ocean currents, \*Winds, \*Topography, Circulation, \*Water circulation, Ocean cir-

Identifiers: \*New Zealand, Tasman Current, West Wind Drift, Trade Wind Drift, Drift cards.

Recoveries of drift cards from releases made off the New Zealand coast in the twelve months preceding July 1954 demonstrate the existence of a

### Group 2E—Streamflow and Runoff

coastal circulation, dependent on the surrounding oceanic currents and the topography for its basic pattern. The coastal current system around New Zealand driven by three major oceanic surface current systems — the Tasman Current, West Wind Drift and Trade Wind Drift — is conditioned by the orientation of the coastline and modified in places by extremes of local winds. The directions of flow within the system are consistent. Coastal influence including that of wind and topography is apparently limited to a zone extending round the shore 100 miles wide off the west coast and 50 miles wide off the east coast. (Sinha-OEIS)

LABORATORY INVESTIGATIONS OF WHITECAPS, SPRAY AND CAPILLARY WAVES.

WAVES,
Florida Univ., Gainesville. Coll. of Engineering.
O. H. Shemdin, R. J. Lai, A. Reece, and G. Tober.
Available from NTIS, Springfield, Va. 22151 as
AD-759 407 Price \$3.00 printed copy. Florida
University Coastal and Oceanographic Engineering Laboratory Technical Report No 11,
December 1972. 101 p, 44 fig, 10 tab, 28 ref. USN
Contract N62306-71-C-0033.

Descriptors: \*Ocean waves, \*Sea spray, \*Winds, Laboratory tests, Florida, Analytical techniques, Photography, Anemometers, Waves (Water), Wind velocity, Measurement. Identifiers: \*Whitecaps (Waves), \*Capillary waves, Laser-optical device.

Laboratory investigations of whitecaps, spray and capillary waves were conducted in the wind and wave facility at the University of Florida. The percent whitecan area coverage was obtained by taking photographs of the water surface and calibrating for the photographed area distortion. Spray was measured by using a constant temperature hot-wire anemometer system. Calibration was achieved by generating uniform size drops with capillary tubes of different sizes and a crystal vibrator. Capillary waves were investigated by a laser-optical device with a frequency response greater than 100 Hz. The device was designed for the purpose of investigating the dependence of capillary waves on the wind speed. The whitecap study indicated a direct dependence of the percent whitecap area coverage on the wind speed. The presence of small amplitude mechanical waves reduces the whitecap coverage. Unstable mechanical waves increase the whitecap area coverage, however. The spray study showed that drops above the water surface interfere with the microwaves detected by a radiometer but not those detected by a radar (x-band). The capillary wave study indicated a direct increase in capillary wave energy with speed in the range 0 to 10 m/sec. The capillary wave energy is also affected by the presence of mechanical waves which increase the wave energy in the frequency range greater than 5 Hz. (Woodard-USGS) W74-03506

BACKSCATTERING FROM A TWO-SCALE ROUGH SURFACE WITH APPLICATION TO RADAR SEA RETURN,

Kansas Univ./Center for Research, Inc., Lawrence.

For primary bibliographic entry see Field 07B. W74-03509

A NON-COHERENT MODEL FOR MICROWAVE EMISSIONS AND BACKSCATTERING FROM THE SEA SURFACE, Kansas Univ./Center for Research, Inc., Lawrence.

For primary bibliographic entry see Field 07B. W74-03510

THE METEOROLOGICAL EFFECTS ON MICROWAVE APPARENT TEMPERATURES LOOKING DOWNWARD OVER A SMOOTH SEA.

Kansas Univ./Center for Research, Inc., Lawrence. For primary bibliographic entry see Field 07B. W74-03511

SURFACE WAVE RESONANCE ON CON-TINENTAL AND ISLAND SLOPES, Wisconsin Univ., Madison. Mathematics Research Content

M. C. Shen, and R. E. Meyer.

M. C. Shen, and R. E. Meyer. Available from NTIS as AD-665 342, for \$6.00 paper copy, \$1.45 microfiche. MRC Technical Summary Report No. 781, June 1967. 64 p, 12 fig, 11 ref. DA-31-124-ARO (D)-462.

Descriptors: Surface water, \*Beaches, \*Islands, \*Continental slopes, Topography, \*Slopes, \*Waves (Water), Resonance, Coasts. Identifiers: Nearshore, \*Geometrical optics, Surface wave spectra.

Spectra of bounded and unbounded basins are calculated on an asymptotic approximation based on smallness of the seabed slopes. This is shown to lead to a geometrical optics theory of surface waves slightly generalizing Keller's (1958), which is used to extend the known, exact result for an idealized beach to the prediction of the spectra of a variety of more natural water bodies. Attention is directed to cylindrically symmetrical and two-dimensional topographies corresponding respectively to islands and to continental slopes and laboratory channels. Marked differences are found in the character of the spectra for these two types of topography. (Sinha-OEIS)

ON SINGULAR BOUNDARY VALUE PROBLEMS FOR THE EPD EQUATION, Wisconsin Univ., Madison. Dept. of Mathematics.

A. D. 1 aylor. Available from NTIS as AD-478 689, for \$6.00 paper copy, \$1.45 microfiche. Technical Report No. 1202 (27)/4, August 1965. 108 p, 14 fig, 13 ref, append. Nonr 1202 (27), Nonr 562 (34).

Descriptors: \*Waves (Water), \*Beaches, Mathematical models, \*Shallow water, Equations. Identifiers: \*Boundary value problems, \*Wave fronts, Discontinuities.

The Euler-Poisson-Darboux equation arises in the theory of waves on shallow beaches. It is one of the simplest singular partial differential equations. A variety of physically interesting problems may be formulated as 'mixed singular boundary value problems' by prescribing additional data on curves other than the singular line. Problems of this type are well represented by the canonical 'singular boundary value problem'. The 'singular boundary value problem' defines a unique solution which shares the smoothness properties of the data on these characteristics, as defined in terms of semi-Lipschitz conditions. A study of the curious play of wave-front discontinuities of the solutions is included. (Sinha-OEIS)

APPROACH OF TIDES TO THE HAWAIIAN ISLANDS.

Hawaii Univ., Honolulu. Dept. of Oceanography. K. Wyrtki, and V. Graefe. Journal of Geophysical Research, Vol 72, No 8, p 2069-2071, April 15, 1967. 2 fig, 3 ref.

Descriptors: Sea level, \*Waves (Water), \*Currents (Water), \*Winds, \*Hawaii, Tides.
Identifiers: \*Amphidromic tide waves, Trade winds, \*Tidal currents, Molokai Channel (Hawaiian Islands).

Measurements of sea level on Oahu, Hawaii, and of currents in the channel between Oahu and Molokai are used to determine the direction from which the amphidromic tide waves approach the Hawaiian Islands. It is shown that the diurnal tide wave approaches the Islands from the southwest, whereas the semidiurnal approaches them from the northeast. In 1965 current measurements were made in the Molokai Channel between the islands of Oahu and Molokai. The channel is 22 nautical miles wide, has depths of 750 meters in its center, and is oriented in the direction of the trade winds without any obstructions in its approaches. A paddle-wheel current meter anchored 5 miles east of Oahu in over 110-meter depth recorded the current at 20-meter depth every 5 min during the period from March 16 to April 8. Simultaneously, a tide gage was operated in a small yacht harbor at the nearby coast. The current in the Molokai Channel is variable and largely influenced by the winds. The tidal currents are superimposed on the prevailing flow. Only during periods of weak winds are the tidal currents the dominant mode of flow. (Sinha-OEIS) W74-03620

LONGSHORE CURRENTS AND NEARSHORE TOPOGRAPHIES,
Louisiana State Univ., Baton Rouge. Coastal Stu-

Louisiana State Univ., Baton Rouge. Coastal Studies Inst. C. J. Sonu, J. M. McCloy, and D. S. McArthur.

Available from NTIS as AD-661 170 for \$6.00 paper copy, \$1.45 microfiche. Technical Report No 51, Sept 1966. Also in: Proceedings of Tenth Conference on Coastal Engineering Tokyo, Japan, Sept 1966, American Society of Civil Engineers, Vol 1, Part 2, Chap 32, p \$25-549, 1967. 13 fig, 5 tab, 33 ref. Nonr-1575 (03).

Descriptors: \*North Carolina, \*Topography, Shallow water, \*Waves (Water), \*Currents (Water). Identifiers: Outer Banks (NC), \*Longshore currents, Nearshore, Shoaling, Breaking waves.

Validity of seven analytical formula as well as linear and non-linear multiple regressive schemes was tested using field data from the Outer Banks, North Carolina. Generally, agreement proved unsatisfactory. Field experiences indicate that the longshore current is a velocity field consisting of a multitude of velocity vectors whose basic pattern varies depending upon the regimes of wave-current-topography interaction. The need to recognize topography as a responding variable as well as a process variable in the physical scheme of longshore current is emphasized. (Sinha - OEIS) W74-03627

CIRCUIT FOR WATER DEPTH METER, Vexilar, Inc., Minneapolis, Minn. (assignee). For primary bibliographic entry see Field 07B. W74-0366

WIND-DRIVEN WAVES,

L. F. Titov.

Available from NTIS as TT-70-50182 for \$4.75 paper copy, \$1.45 microfiche. NOAA and NSF TT-70-50182. 1971. 244 p, numerous fig and tab, 83 ref. Translation of Vetrovye Volnye, Leningrad, 1969.

Descriptors: \*Waves (Water), Energy transfer, Winds, \*Shallow water, Coasts, Climate. Identifiers: \*Wave theory, \*Wind waves, Swell.

A survey is presented of theory and computation of wind waves in the sea. The theory of wind waves is presented, existing techniques for calculating wind-wave elements are discussed, and attention is given to their practical utilization. (Sinha - OEIS)
W74-03673

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966, VOLUME I. For primary bibliographic entry see Field 08B. W74-03674

NUMERICAL CALCULATION OF WIND WAVES IN SHALLOW WATER, Kyushu Univ., Fukuoka (Japan). Dept. of Hydrau-For primary bibliographic entry see Field 08B. W74-03675

WAVE BOUNDARY LAYERS AND FRICTION FACTORS, Technical Univ. of Denmark, Copenhagen. Coastal Engineering Lab. For primary bibliographic entry see Field 08B.

### 2F. Groundwater

INTEGRATED SYSTEM IDENTIFICATION AND OPTIMIZATION FOR CONJUNCTIVE USE OF GROUND AND SURFACE WATER PHASE I,

Case Western Reserve Univ., Cleveland, Ohio. Systems Engineering Div. Y. Y. Haimes.

Available from the National Technical Information Service as PB-226 869; \$5.00 in paper copy; \$1.45 in microfiche. Ohio State University Water Resources Center, Columbus, Project Completion Report, October 1973. 154 p, 19 fig, 15 tab, 32 ref, 1 append. OWRR-B-045-OHIO (1). 14-31-0001-3926.

Descriptors: \*Groundwater, Surface waters, \*Surface-groundwater relationships, \*Transmissivity, Management, Drawdown, Recharge, Seepage, In-filtration, \*Ohio, Watershed management, \*Conjunctive use, \*Optimization, Computer programs, Model studies.

Identifiers: Miami (Ohio), Conservancy district, Storativity, Computer coding, Parabolic dif-ferential equations, \*Aquifer models.

A system identification methodology, applicable to calibration of confined and unconfined (under to canoration of contineed and uncontineed (under certain constraints) aquifer models described by two dimensional parabolic partial differential equations, has been developed. A computer pro-gram (in FORTRAN IV) simulating an aquifer using an alternating direction implicit terative procedure which has been obtained from the U.S. Geological Survey was utilized as a component in the system identification effort. Work has been completed on the formulation and coding of a digital computer software package (in FORTRAN V) capable of estimating the values of transmissivity as a function of location within the aquifer. The identification methodology has been successfully applied to the parameter identification of an aquifer model simulating the behavior of a real aquifer system. The Fairfield-New Baltimore aquifer in southern Ohio was chosen as the problem site in collaboration with the Miami Conservancy District. The validated aquifer model is most valuable to engineers and managers con-cerned with groundwater systems wishing to know the response of the aquifer system to various de-mands placed upon it. The model will be fully utilized for the conjunctive management of ground and surface water developed in Phase II of this project. W74-03201

DEDUCTION OF FLOW PATTERNS IN VARIA-BLE-DENSITY AQUIFERS FROM PRESSURE AND WATER-LEVEL OBSERVATIONS, RID WATER-LEVEL OBSERVATIONS, Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 04B. W74-03236

RETENTION OF DISSOLVED CONSTITUENTS OF WASTE BY GEOLOGIC MEMBRANES, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 05B. W74-03238

HYDROGEOLOGY OF SUBSURFACE LIQUID--WASTE STORAGE IN FLORIDA, Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 05E. W74-03361

FEASIBILITY STUDY OF LIQUID-WASTE IN-JECTION INTO AQUIFERS CONTAINING SALT WATER, WILMINGTON, NORTH CAROLINA,
North Carolina Dept. of Natural and Economic

Resources, Wilmington. Office of Water and Air For primary bibliographic entry see Field 05E. W74-03362 Resources.

LIMESTONE SPRINGS AND INDIVIDUAL FLOOD EVENTS, (WITH SPECIAL REFERENCE TO THE GOWER PENINSULA, WALES).

University Coll. of Swansea (Wales). Dept. of Geography. W. J. Chambers.

Transactions of the Cave Research Group of Great Britain, Vol 15, No 2, p 91-97, June 1973. 7 fig, 1

Descriptors: \*Springs, \*Karst hydrology, \*Water chemistry, Karst, Limestones, Carbonate rocks, Limestones, Rainfall-runoff relationships, Antecedent precipitation.
Identifiers: \*Wales (Gower peninsula).

All springs in the Gower Peninsula of Wales show a positive relationship with precipitation in field capacity conditions. The total hardness concentration varies directly, inversely, or not at all with precipitation. The nature of the relationship between discharge and total hardness concentration controls the total solute load and denudation rates. Intensive hourly or two-hourly automatic water sampling is a useful technique in the un-derstanding of the chemical variation of springs. Such sampling, coinciding with stormy conditions, allows a fairly complete picture to be gained after a relatively short period of time. In certain conditions this is preferable to weekly, fortnightly, or monthly sampling programs lasting over a year. Short interval sampling also means that short-lived chemical effects are not missed. (Knapp-USGS) W74-03512

FORCED FLOW PASSAGES IN KARST MAS-

Genoa Univ. (Italy). Inst. of Geography. For primary bibliographic entry see Field 02J. W74-03513

SOME CALCULATIONS OF THE DENUDA-TION RATE IN A DOLOMITIC LIMESTONE AT ISFJORD-RADIO, ZBERGEN,

Lund Univ. (Sweden). Dept. of Physical Geog-For primary bibliographic entry see Field 02J. W74-03514

HYDROGEOLOGIC CONSIDERATIONS IN LAND SPREADING OF SEWAGE TREAT-MENT-PLANT EFFLUENT IN CENTRAL FLORIDA, Geological Survey, Winter Park, Fla. Water

Resources Div.
For primary bibliographic entry see Field 05D.

### 2G. Water in Soils

GULLY BANK EROSION: MECHANICS AND SIMULATION BY DIGITAL COMPUTER, Iowa State Univ., Ames. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 02J. W74-03202

EDAPHIC FACTORS AND WILT OF CORI-ANDER, Rajasthan Univ. Jaipur (India). For primary bibliographic entry see Field 05C. W74-03281

VIRUS REMOVAL IN HAWAIIAN SOILS. Hawaii Univ., Honolulu. For primary bibliographic entry see Field 05F. W74-03293

SATURATED WATER FLOW THROUGH CLAY POTS, Illinois Univ., Urbana. Dept. of Plant Physiology and Horticulture.
For primary bibliographic entry see Field 03F.
W74-03306

ENRICHMENT OF MARSH HABITATS WITH ORGANIC WASTES, Louisiana Water Resources Research Inst., Baton For primary bibliographic entry see Field 05D. W74-03337

POTENTIAL OF AN ERODING URBAN SOIL FOR THE PHOSPHORUS ENRICHMENT OF STREAMS: I. EVALUATION OF METHODS, Massey Univ., Palmerston North (New Zealand). For primary bibliographic entry see Field 05B. W74-03438

EFFECT OF PHOSPHATE AND CHLORIDE

SALTS ON AMMONIFICATION IN WATER-LOGGED SOILS, Wisconsin Univ., Madison. Dept. of Soil Science. J. A. Ryan, J. L. Sims, and D. E. Peaslee. Soil Sci Am Proc. Vol 36, No 6, p 915-917. 1972. Il-

Identifiers: \*Ammonification, \*Chlorides, \*Phosphates, Phosphorus, Potassium, Salts, Sodium, \*Soils (Waterlogged).

Extractable NH4+ in samples of soil incubated under waterlogged conditions increased as the time of incubation increased but decreased as the concentration of salt increased. The critical con-centration for KH2PO4, NaH2PO4, KCl and NaCl was about 2.5 x 10-2 M. The K salts generally depressed ammonification more than the Na salts, while Cl salts generally had greater effects than the P salts.—Copyright 1973, Biological Abstracts, W74-03445

ORGANIC COMPOUNDS IN SOIL WATER OF SOME ULTISOLS OF THE ATLANTIC COASTAL PLAIN,

North Carolina State Univ., Raleigh. Dept. of Soil

W. D. Nettieton, and R. J. McCracken.
J Environ Qual, Vol 1, No 4, p 387-390, 1972.
Identifiers: Agricultural chemicals, \*Atlantic
Coastal Plains, Compounds, \*North Carolina,
\*Organic compounds, Phenols, \*Soil water, Sugars, \*Ultisols, Water.

Water samples collected from undisturbed, uncultivated, forested soils of the Atlantic Coastal Plain in Wilson County, North Carolina, were analyzed for content and composition of natural organic

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substances. Sugars, organic acids, and polyphenols were detected. These results should be useful 'baseline data' for comparison with water in and from soils to which agricultural chemicals and organic wastes have been added.--Copyright 1973, Biological Abstracts, Inc.

SOIL SURFACE ROUGHNESS AND STRAW MULCH FOR MAXIMUM BENEFICIAL USE OF RAINFALL BY CORN ON A BLACKLAND

Agricultural Research Service, State College,

For primary bibliographic entry see Field 03F. W74-03515

IS PHOSPHATE REDUCED TO PHOSPHINE IN

WATERLOGGED SOILS, Reading Univ. (England). Dept. of Soil Science. J. R. Burford, and J. M. Bremner.

Soil Biol Biochem. Vol 4, No 4, p 489-495. 1972. Il-

lus.
Identifiers: Detectors, \*Gas chromatography.
\*\*Convention, \*Phosphates, \*Phosphine, Helium, Ionization, \*Soils (Waterlogged).

A sensitive gas chromatographic method for detection and estimation of phosphine (PH3) evolved from waterlogged soils is described. It involves use of a column of Porapak Q for isothermal (100 deg C) separation of phosphine from gases known to be evolved from waterlogged soils and detection of this gas with a helium-ionization detector. Stu-dies using this method did not confirm previous for evolution of phosphine through microbial reduction of phosphate in waterlogged soils. They also showed that phosphine is sorbed by soil constituents and may not escape to the atmosphere if produced in soils .-- Copyright 1973, Biological Abstracts, Inc. W74-03523

### 2H. Lakes

BOTTOM MACROFAUNA IN THE GOCZAL-KOWICE DAM RESERVOIR IN THE YEARS 1965-1969.

Polish Academy of Sciences, Pszczyna. Hydrobiological Station.
For primary bibliographic entry see Field 05C.
W74-03271

FIELD STUDIES ON PHOTOSYNTHESIS OF CLADOPHORA GLOMERATA (CHLOROPHYTA) IN GREEN BAY, LAKE

MICHIGAN, Wisconsin Univ., Madison. Dept. of Botany For primary bibliographic entry see Field 05C. W74-03274

SOME ARCTIC LIMNOLOGY AND THE HIBERNATION OF INVERTEBRATES AND SOME FISHES IN SUB-ZERO TEMPERA-TURES.

Naturhistoriska Riksmuseet, (Sweden). Section for Invertebrate Zoology. C. Holmquist.

Archiv fur Hydrobiologie, Vol 72, No 1, p 49-70, June 1973. 1 fig, 87 ref.

Descriptors: \*Overwintering sites, \*Cold resistance, Aquatic plants, \*Oligochaetes, \*Mollusks, \*Diatoms, \*Chlorophyta, \*Cyanophyta, Sampling, Water temperature, Aquatic habitats, \*Alaska, Lakes, Freezing, Permafrost, Benthic fauna, Crustaceans, Aquatic insects, Nematodes, Diptera, Snails, Clams, Rotifers, Waterfleas, Cad-disflies, Nostoc, Chara, Daphnia. Identifiers: Survival, Hydrozoans, Turbellaria, Tardigrades, Gastrotrichd, Polychaetes, Leeches,

Hydrachnids, Bryozoa, Porifera, Macroinver-tebrates, Coelenterates, Water bears, Nitella, Potamogeton, Lemna trisulca, Ceratophyllum demersum, Hydra, Macrostomum, Castrada spinulosa, Mesostoma lingua, Manayunkia speciosa, Alexandrovia, Trichodrilus, Rhynchelmis, Lumbriculus variegatus, Glossiphonia complanata, Eurycercus, Sphaeri Physa, Gyraulus, Valvata, Sphaerium, Lymnaea, Oedogonium

Five shallow (less than 2 m depth) lakes in permafrost areas of northern Alaska were investigated to determine whether bottom-living animals occur and survive in frozen environments. Samples were collected in the summer of 1970. A number of macroscopic plants, algae, and animals were identified. The animals included Hydrozoa, Turbellaria, Tardigarda, Gastrotricha, Polychaeta, Oligochaeta, Hirudinea, Crustacea, Insecta, Hydrachnida, Mollusca, Bryozoa, Porifera, Nematoda, and fish. The results of the survey are discussed with respect to the possible winter temperatures of the bottom habitats for invertebrates of such areas, the frost resistance of invertebrates, the oxygen supply, the mode of hibernating in invertebrates, and the actual lakes with their animals. The available literature on low temperature survival of invertebrates is also reviewed. Since the area concerned is compound and varied topographically, geologically and climatically, and the invertebrates live in microclimatic and microecological conditions as compared with the larger, more mobile vertebrates, it is impossible to deduce anything as regarding the winter conditions of the actual lakes or the frost-resistance of animals existing there from what is known from the better-investigated temperate areas or from laboratory conditions. (Little-Battelle) W74-03275

AN IN SITU EXAMINATION OF THE GRAZING ACTIVITIES OF NATURAL ZOOPLANKTON COMMUNITIES,

Toronto Univ. (Ontario). Dept. of Zoology. For primary bibliographic entry see Field 05C. W74-03276

THE OCCURRENCE OF MICROTURBEL-LARIA IN SOME BRITISH LAKES OF DIVERSE CHEMICAL CONTENT, Liverpool Univ. (England). Dept. of Zoology. For primary bibliographic entry see Field 05C. W74-03282

STUDIES ON PHYTOPLANKTON IN RELATION TO ITS PRODUCTION AND SOME PHYSICAL-CHEMICAL FACTORS IN LAKE

SVINSJOEN, Oslo Univ. (Norway). Dept. of Limnology. For primary bibliographic entry see Field 05C. W74-03284

THEORETICAL EFFECTS OF ARTIFICIAL DESTRATIFICATION ON ALGAL PRODUC-TION IN IMPOUNDMENTS, Harvard Univ., Cambridge, Mass. Lab. of Applied

Microbiology.

For primary bibliographic entry see Field 05C. W74-03296

HALF-SATURATION CONSTANTS FOR UP-TAKE OF NITRATE AND AMMONIA BY RESERVOIR PLANKTON, Oklahoma State Univ., Stillwater. Dept. of Zoolo-

gy. For primary bibliographic entry see Field 05C. W74-03299

COMPARATIVE ECOLOGY AND ZOOPLANK-TON OF TWO MARYLAND PONDS INCLUD-

ING A CONGENERIC OCCURRENCE OF DIAP-TOMUS (CALANOIDA: COPEPODA), Edgewood Arsenal, Aberdeen Proving Ground, Md. For primary bibliographic entry see Field 05C. W74-03308

A CONTRIBUTION TO THE ECOLOGY AND DISTRIBUTION OF AQUATIC ACARI IN THE ST. LAWRENCE GREAT LAKES, Wisconsin Univ., Milwaukee. Center for Great

Lakes Studies. For primary bibliographic entry see Field 05C. W74-03314

OBSERVATIONS ON RED COLORED CELLS OF PERIDINIUM WISCONSINENSE FROM BUCKHORN LAKE, ONTARIO, Guelph Univ. (Ontario). Dept. of Zoolog For primary bibliographic entry see Field 05C. W74-03320

SPECTRAL ANALYSIS OF SHALLOW WATER WAVES IN LAKE MICHIGAN, United States Lake Survey, Detroit, Mich. P.C. Lin.

In: Proceedings of Conference (11th) on Great Lakes Research, Milwaukee, Wisconsin, 1968, p 412-423. 9 fig, 7 ref.

Descriptors: \*Shallow water, \*Waves (Water), \*Lake Michigan, \*Coasts, Wind velocity, Lakes. Identifiers: \*Spectrum analysis, Energy spectrum,

Wave characteristics derived from spectral analysis of waves measured near Pentwater Harbor, Lake Michigan, were correlated with wind histories. The energy spectrum of shallow water waves generally resembles that of deep water waves. The effect of shallow water becomes dominant for the extended high intensitywind field. The appearance of two spectral peaks usually denotes the spectrum relating to a decreasing speed wind field. (Si W74-03439

ECOLOGICAL STUDIES ON DISSOLVED OX-YGEN AND BLOOM OF MICROCYSTIS IN LAKE SUWA: I. HORIZONTAL DISTRIBUTION OF DISSOLVED OXYGEN IN RELATION TO DRIFTING OF MICROCYSTIS BY WIND, Shinshu Univ., Suwa (Japan). Suwa Hydrobiological Station.

For primary bibliographic entry see Field 05C. W74-03524

BIOGENIC METAMORPHOSIS OF WATER IN LAKES OF THE AMU-DAR'YA DELTA BIOGENNOY METAMORFIZATSII VODY OZERAKH DEL'TY AMUDAR'I), L. G. Konstantinova

In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 52-59, 1972. 3 fig, 6 tab, 20 ref.

Descriptors: \*Water chemistry, \*Reduction (Chemical), \*Sulfates, \*Lakes, \*Deltas, Inorganic compounds, Sulfides, Hydrogen sulfide, Sulfur bacteria, Microbiology, Water sampling, Water Identifiers: \*USSR (Amu-Dar'ya River), Water

exchange, Mineralization.

Biogenic reduction of sulfates in lower reaches of the Amu-Dar'va delta in Kara-Kalpak ASSR was investigated in the Dautkul' group of lakes and in Lakes Koksu, Shegekul', Karateren', and Ashchikul'. Biogenic reduction of sulfates is widespread in water bodies of the Amu-Dar'ya delta. Intensification of sulfate reduction was observed in the lakes in the absence of water exchange and, in an isolated water sample, there

was an almost complete reduction of sulfates. (Josefson-USGS) W74-03531

ION LOAD AND CARBONATE EQUILIBRIUM IN THE TROITSK RESERVOIR (AKKUMU-LYATSIYA IONNOGO STOKA I KARBONAT-NOYE RAVNOVESIYE V TROITSKOM VODOKHRANILISHCHE), Magnitogorskii Gorno-Metallurgicheskii Institut

Z. F. Krivopalova, and K. B. Zhaggar.

In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 46-51, 1972. 1 fig, 5 tab, 19 ref.

Descriptors: \*Water chemistry, \*Reservoirs, \*Ions, \*Calcium carbonate, \*Equilibrium, Saturation, Supersaturation, Inorganic compounds, Cardioxide, Chlorides, Sulfates, Discharge (Water), Seasonal, Equations.
Identifiers: \*USSR (Troitsk Reservoir).

The Troitsk Reservoir in southern Chelvabinsk Oblast was constructed in 1960 on the Uy River, a tributary of the Tobol. Total ion load in the tailrace channel of the reservoir in 1965 was 2% greater than the load carried by the streams. The Cl load increased by 16%, and the SO4 load decreased by 10%. Regulation of the Uy River resulted in a reduced ion load in spring and summer and in an increased ion loan in winter. Water of the Uy River in upper reaches of the reservoir in winter. and spring was unsaturated by CaCO3, and the concentration of aggressive CO2 was high (17.6-24.2 mg/liter). In reservoir reaches where an artificial heat regime was formed, the water was almost always saturated or supersaturated by CaCO3.

During the flood of April 1965, the concentration of aggressive CO2 was below permissible limits osed no threat to concrete structures. (Josefson-USGS) W74-03532

TECHNIQUES IN FORECASTING CONTENT OF ORGANIC AND BIOGENIC SUBSTANCES WATER OF EXISTING AND PROPOSED WATER BODIES NOZIROVANIYA (K METODIKE PROG-SODERZHANIYA OR-(K BIOGENNYKH VODE VESHCHESTV SUSHCHEST-VUYUSHCHESIV VODE SUSHCHESIV

Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. Yu. G. Maystrenko, and A. I. Denisova.

In: Metody khimicheskogo analiza i sostav prirod-nykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 86-114, 1972. 12 fig, 14 tab, 33 ref.

Descriptors: \*Water chemistry, \*Organic compounds, \*Inorganic compounds, \*Reservoirs, \*Forecasting, Nitrogen compounds, Phosphorus compounds, Gases, Oxidation, Vegetation, Aquatic plants, Plankton, Soils, Precipitation (Atmospheric), Equations.
Identifiers: \*USSR, Kiev Reservoir, Kremenchug

Reservoir, Kakhovka Reservoir, Organic carbon.

Water- and salt-balance equations and empirical coefficients for different types of vegetation, plankton, and soils can be used to forecast organic and biogenic substances in proposed bodies of water. Suggested techniques for forecasting organic and biogenic substances were tested in the Kiev, Kremenchug, and Kakhovka Reservoirs on the Dnieper River by comparing computed values of organic carbon, organic nitrogen, permanganate and bichromate oxidizability, ammonium and nitrate-nitrogen, and total and dissolved nitrate-nitrogen, and total and dissolved phosphorus with field data obtained during the first years of reservoir impoundment. Differences een average annual concentrations of organic and biogenic substances in reservoir water and predicted values range from minus 0.9% to +5.0% for carbon, from +5.5% to minus 9.0% for organic nitrogen, from minus 0.9% to minus 5.5% for per-manganate oxidizability, from +1.0% to minus for bichromate oxidizability, from minus +3.0% to +21.0% for ammonium nitrogen, from +3.0% to minus 7.0% for nitrate nitrogen, and from +7.5% to +32.0% for total and dissolved phosphorus. (Josefson-USGS) W74-03535

DELAYED RECOVERY OF A MESOTROPHIC LAKE AFTER NUTRIENT DIVERSION,
Battelle-Pacific Northwest Labs., Richland,

For primary bibliographic entry see Field 05C. W74-03560

IMPORTANCE OF DIATOMS IN THE PRESENT VARVE DEPOSITION (ALTERNA-TION OF ANNUAL LAYERS) OF GREEN LAKE (NEAR FAYETTEVILLE, N.Y.), MODEL OF CONFINED SEDIMENTATION, (IN FRENCH), Museum National d'Histoire Naturelle, Paris G. Busson, S. D. Ludiam, and D. Noel.
C. R. Hebd Seances Acad Sci Ser D Sci Nat. Vol.

247, No 23, p 3044-3047. 1972. Illus.

Identifiers: Annual, \*Diatoms, Lakes, Layers, Minerals, Model studies, \*New York (Green Lake), Organic, Sedimentation, \*Varve deposi-

The Green Lake varves, model of present layered sedimentation, can hardly be considered as a case of exclusively chemical sedimentation. Thus, these varves are closer to conventional laminae involving the combination of organic matter with mineral matter. In these laminites the plankton organisms have a constitutive role which is equally significant within layers with 'organic matter' as in the mineral layers. In the mineral layers, fragments of calcareous nannoplankton or frustules of diatoms or others are involved .-- Copyright 1973, Biological Abstracts, Inc. W74-03577

WIND DRIVEN WATER CURRENTS, Toronto Univ. (Ontario). Dept. of Mechanical En-

gineering.
For primary bibliographic entry see Field 08B. For primary W74-03619

WINDS, WIND SET-UPS, AND SEICHES ON LAKE ERIE,

United States Lake Survey, Detroit, Mich. For primary bibliographic entry see Field 08B.

THE FORMATION OF PHYTOCENOSES ON THE LIBERATED GROUND OF LAKE SEVAN, (IN RUSSIAN), Moscow State Univ. (USSR). Dept. of Biogeog-

raphy.
A. G. Voronov, and R. O. Geodakyan.
Bio Zh Arm. Vol 25, No 3, p 72-78. 1972. Illus.
Identifiers: Chenopodium-Album, Crambe-Orientalis, Estuaries, Glyceria-Aquatica, Glyceria-Plicata, Jacker community, Juncus-Buylonius, Lakes, Phragmites-Communis, \*Phytocenoses, Polygonum-Aviculare, Rivers, Trifolium-Repens, \*USSR (Lake Sevan), Veronica-Anagalis-Aquatica, \*Overgrowth.

First stages of overgrowth with mixed pioneer groups of plants were observed in 1969 on sand bars and estuaries of rivers Martuni and Argichi (USSR). The first plants were Glyceria aquatica, Veronica anagalis aquatica, Juncus bufonius, Polygonum aviculare and other annual plants with ckar community coefficient as low as 38% During the second yr, many more and different plants, predominantly perennial ones, including Trifolium repens, appeared, raising the coefficient to 62% at the Argichi river and 100% at the Martuni river. The phytocenosis on the brows of the lake was of different character, since the surf exerted a mechanical and packing effect on the ground which effected the selection of plants. Here were observed Chenopodium album, and Polygonum aviculare (annuals) and Crambe orientalis, Phragmites communis, and Glyceria plicata (perennials).—Copyright 1973, Biological Ab-W74-03632

READILY HYDROSABLE ORGANIC MATTER IN BOTTOM SEDIMENTS OF LAKE BAIKAL, (IN RUSSIAN), For primary bibliographic entry see Field 05C. W74-03715

### 2I. Water in Plants

THE CONSTRUCTION OF A SAND PROFILE SAMPLER: ITS USE IN THE STUDY OF THE VORTICELLA POPULATIONS AND THE GENERAL INTERSTITIAL MICROFAUNA OF SLOW SAND FILTERS,

Surrey Univ., Guilford, (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 05A.
W74-03286

STREPTOCEPHALUS MOOREI N. SP., A NEW FAIRY SHRIMP (ANOSTRACA) FROM MEX-

Arizona State Univ., Tempe. Dept. of Zoology.

Transactions of the American Microscopical Society, Vol 92, No 3, p 507-512, July 1973. 7 fig, 3

Descriptors: \*Crustaceans, Aquatic animals, \*Systematics, \*Speciation, Invertebrates, \*Mex-

Identifiers: \*Fairy shrimp, \*Streptocephalus moorei, Animal morphology, Anostraca, Macroinvertebrates, Scanning electron microscopy, Sample preparation, Sample preservation.

More than 200 specimens of the genus Streptocephalus were collected in Chihuahua, Mexico, and fixed in 70 percent ethanol. A few specimens were washed in several changes of distilled water for 24 hr before placing them in 10 percent formalin for 24 hr. The fairy shrimp were percent formatin for 2- in. The stary states of then prepared for study by scanning electron microscopy. The Anostraca collected were a new species, S. moorei; the species is fully described and compared with other species already known for the genus. (Holoman-Battelle) W74-03319

FORMATION OF THE ANNUAL RING AND THE ACCUMULATION OF ORGANIC MATTER IN TREES, (IN RUSSIAN).

Sovetskii Natsionalnyi Komitet po Provedeniyu Mezhdunarodnoi Biologicheskoi Programmy, Moscow (USSR).

Nauka: Moscow. 1970. 129 p. Illus. Identifiers: Accumulation, Deficiency, Forma-tion, Light, Moisture, \*Organic matter, Precipita-tion, Productivity, Temperature, \*Tree rings (An-nual).

The diameter increment of trees in different geographical zones and the external (solar radiation, air temperature, precipitation) and internal factors (moisture deficiency in the tree) in the formation of the annual ring are discussed. The relation between the tree increment and the climate fluctuations is described, and ways of forecasting the variations of climate are presented. The produc-

### Group 21-Water in Plants

tivity of trees and stands, the dynamics of accumulation of organic matter, and an analysis of the distribution of the organic matter within the tree are discussed .-- Copyright 1973, Biological Ab-W74-03466

PHYSIOLOGY OF DROUGHT RESISTANCE IN THE SOYBEAN PLANT (GLYCINE MAX): I.
THE RELATIONSHIP BETWEEN DROUGHT RESISTANCE AND GROWTH. Sheffield Univ. (England). Dept. of Botany For primary bibliographic entry see Field 03F.

THE FEEDING ECOLOGY OF THE ROCK GREENLING, HEXAGRAMMOS LAGOCEPHA-LUS, IN THE INSHORE WATERS OF AMCHIT-KA ISLAND, ALASKA, Washington Univ., Seattle. Coll. of Fisheries.

C. A. Simenstad.

W74-03475

Available from the National Technical Information Service as TID-26129 \$3.00 in paper copy copy, \$1.45 in microfiche. M Sc Thesis, 1971. 131 p, 14 fig, 16 tab, 60 ref, 3 append. AEC Contract AT (26-1)-171.

Descriptors: \*Fish food organisms, \*Ecosystems, \*Aquatic life, \*Alaska, Surveys, Food habits, Aquatic algae, Aquatic animals, Aquatic environment, Growth stages, Fish diets, Analytical techniques, Biomass. Hexagrammos

Identifiers: \*Rock greenling, Hex lagocephalus, Amchitka Island (Alaska).

Analysis of the stomach contents of 596 rock greenling, Hexagrammos lagocephalus, collected from the inshore waters of Amchitka Island, Alaska, indicated the fish to be a benthophage ingesting a diverse spectrum of macroinvertebrates, fish, and algae. Prey organisms represented exclusively from both intertidal or subtidal habitats suggest movement onto the intertidal bench during high tide for the purpose of feeding. Diet composition of indetifiable food organisms by biomass consisted of amphipods (43.2%), miscellaneous organisms and identifiable nonfood matter (31.9%), mysids (10.2%), molluscs (6.4%), fish (4.5%), decapoda (2.8%), and copepods (1.0%). Rank by percentage occurrence was similar except for reversal of the mollusc and mysid categories. Greenling appear to feed continuously with a slight diurnal emphasis and to have a relatively high proportion of digested food in the stomach. While no differences in the annual composition of the diet was noted in 1968-1970, the yearly total biomass ingested per fish was significantly different.
(Woodard-USGS) W74-03505

LIFE CYCLE OF ORCHARDGRASS (DACTYLIS GLOMERATA L.) IN THE FLOOD MEADOWS OF THE OKA RIVER: I, (IN RUS-

SIAN), V. N. Egorova. Byull Mosk O-Va Ispyt Prir Otd Biol, Vol 77, No 4, p 118-129, 1972, Illus, English summary. Grass, \*Life cycle, Ontogeny, \*Orchard grass, River, \*USSR (Oka River).

Eleven age groups are recognized in the ontogenesis of D. glomerata, based on the complex of biomorphological characters of the overground and underground organs of the plant as observed in the USSR. The individual, developing from a seed, does not preserve its integrity through its whole life. With aging of the individuals, the character of the tillering undergoes substantial changes. During the second half of the ontogenesis, the longevity of the shoots decreases.—Copyright 1973, Biological Abstracts, Inc. W74-03604 THE STRUCTURE OF SAPROBIC COMMUNI-TIES.

Prague Dept. of Water Technology (Czechoslovakia). V. Sladecek.

Int Rev Gesamten Hydrobiol, Vol 57, No 3, p 361-366, 1972, Illus.

Identifiers: Decomposition, \*Eltonian pyramid. \*Saprobic communities.

Eltonian pyramids have served as patterns to show the structure of saprobic communities. A saprobic triangle was developed and divided irregularly into zones occupied by producers, consumers and decomposers. Subdivisions were made in each zone and the left half of the triangle was depicted twice in more detail (plankton and benthos being considered separately). Lastly, a saprobic half-cir-cle was introduced in which both plankton and benthos were considered at the same time. All schemes cover only freshwater and are considered as tentative. They may be corrected, improved and developed.--Copyright 1973, Biological Abstracts, W74-03746

### 2J. Erosion and Sedimentation

GULLY BANK EROSION: MECHANICS AND SIMULATION BY DIGITAL COMPUTER, Iowa State Univ., Ames. Dept. of Agricultural Engineering.

J. C. Taylor, and H. P. Johnson. Available from National Technical Information Service as PB-227 017; \$12.00 in paper copy, \$1.45 in microfiche. Iowa Water Resources Research Institute, Ames, Completion Report ISWRRI-48, September, 1973. 163 p, 20 fig, 2 tab, 34 ref. OWRR A-034-IA (1).

Descriptors: \*Simulation analysis, Computer models, \*Bank erosion, \*Gully erosion, Erosion rates, Computer programs, \*Bank stability, Groundwater, Seepage, \*Soil erosion, \*Iowa.

The main objective was to develop concepts of the mechanics of gully bank failures, specifically, the effect of groundwater on soil shear strength and the interaction with gravitational forces on the soil. The concepts were expressed as digital computer programs that evaluate gully bank stability. wo groundwater flow systems defined as boundary value problems were solved for the hydraulic potential function by a modified Gram-Schmidt technique. One model can be used to evaluate effects of seepage recharge on groundwater flow into the gully. The second was used to analyze the effects of water table fluctuations in the vicinity of the gully bank, notably cases of rapid drawdown. The solutions apply to gullies with sloping banks which are seepage faces for groundwater. The results generated by the model using typical dimensions and soil parameters for gullies in loess soils of western Iowa were not compared directly to field cases. However, the reactions of the mod to variations in water table heights and changes in the cohesion intercept of the Mohr-Coulomb Failure Law were in accordance with general field experience. W74-03202

MISSISSIPPI PROCEEDINGS. WATER RESOURCES CONFERENCE, 1973 Mississippi State Univ., State College. Water Resources Research Inst. For primary bibliographic entry see Field 05B. W74-03212

CHEMICALS IN SEDIMENTS FROM RESER-VOIRS IN NORTH MISSISSIPPI, Mississippi Univ. University For primary bibliographic entry see Field 05B. W74-03213

SEDIMENT YIELD ESTIMATES BASED ON FLOODWATER MEASUREMENTS AND SAM-

Agricultural Research Service, Oxford, Miss. Sedimentation Lab.

J. C. Willis, A. J. Bowie, and D. A. Parsons. In: Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, p 13-29, 1973. 7 fig, 9 tab, 10 ref.

Descriptors: \*Sediment transport, \*Streamflow, \*Sediment yield, \*Mississippi, Floods, Flow rates, Correlation analysis, Sediments, Particle size, Sediment control, Erosion control, Data collections, Sampling, Planning, Levees.
Identifiers: \*Coles Creek (Miss), \*Buffalo River (Miss).

An investigation was conducted in southwest Mis-sissippi in cooperation with the Soil Conservation to determine the sediment yields of Coles Creek and Buffalo River. The watershed areas are 257 sq mi and 182 sq mi, respectively. The floodwater sampling and water discharge measurements were made during August 1967 to April 1969. The sedi-ment contents of floodwater samples were related to water flow rates to give sediment-water discharge ratings for both sands and fine sedi-ments. Flow-duration relationships were established which defined the relation between established which defined the relation between water flow rate and the proportion of the time that the rate was exceeded. The flow-duration relation-ships were then combined with the flow-sediment discharge information to give sediment disch time association in the form of curves and tables of rates of sediment discharge against the propor-tion of the total time during which they occur. The measured sand yields were at about the same rate for the two watersheds: 1.00 ton/acre/year and 1.21 tons/acre/year for Coles Creek and Buffalo River, respectively. The big difference was in the yield of fines: 4.56 tons/acre/year for Coles Creek and 1.71 tons/acre/year for Buffalo River. (See also W74-03212) (Woodard-USGS) W74-03214

RESPONSE OF THE LOWER MISSISSIPPI RIVER TO CHANGES IN VALLEY SLOPE, SINUOSITY AND WATER TEMPERATURE, Army Engineer District, Vicksburg, Miss. For primary bibliographic entry see Field 02E. W74-03216

AND ACCUMULATION SEDIMENT DURING B MOVEMENT BASIN SUSPENDED RECHARGE, Southwestern Great Plains Research Center, Bushland, Tex. For primary bibliographic entry see Field 04B. W74-03240

TRACE ELEMENTS IN BOTTOM SEDIMENTS OF DNIEPER RIVER (MIKROELEMENTY V DO R RIVER RESERVOIRS NTY V DONNYKH OTLOZ-VODOKHRANILISHCH R. HENTYAKH DNEPRA),

Akademiya Hidrobiologii. Nauk URSR, Kiev. Instytut For primary W74-03254 bibliographic entry see Field 02K.

SEDIMENT COLIFORM POPULATIONS AND POST CHLORINATION BEHAVIOR OF WASTEWATER BACTERIA, Harris County Pollution Control Dept. Houston, Tex. For primary bibliographic entry see Field 05A. W74-03295

MORPHOMETRIC ANALYSIS OF SHORT--FERIOD CHANGES IN THE TOPOGRAPHY OF THE SHORE, Akademiya Nauk SSSR, Kaliningrad. Institut

V. R. Boynagryan. Oceanology, Vol 6, No 4, p 534-540, April 1967. 4 fig, 4 tab, 14 ref.

Descriptors: \*Sediment transport, \*Topography, Morphology, Slopes, \*Beaches, Shores, \*Coasts, Shallow water. Identifiers: \*Baltic Sea, Morphometric analysis.

Experimental field data are presented to support the view that it is possible to estimate mass m ments of sand indirectly by studying the morphometry of the submarine beach slope and by material-moving forces computing hydrometeorological methods for the period of observation. An attempt is made using morphometric analyses to explain reconstruction of the topography of the submarine beach slope in a shallow-water area in the Southeastern Baltic. The information employed was obtained in the summer of 1963 during operations of an expedition from the Institute of Oceanography, USSR Academy of Sciences and the Institute's Kaliningrad Department. Soundings were made using a PEL-2 echosounder installed aboard a BAV amphibious vehicle over an area 950 m long, along 19 parallel lines 50 m apart, orientated normal to the coast. (Sinha-W74-03341

EFFECTS OF PARTICLE SIZE AND WAVE STATE ON GRAIN DISPERSION. Chicago Univ., Ill. Dept. of Geophysical Sciences. For primary bibliographic entry see Field 02L.

W74-03344

RECENT COASTAL SEDIMENTATION: CEN-TRAL LOUISIANA COAST,
Louisiana State Univ., Baton Rouge. Coastal Stu-For primary bibliographic entry see Field 02L. W74-03345

TRACE-ELEMENT DISTRIBUTION IN THE CONTINENTAL-SHELF SEDIMENTS OFF THE EAST COAST OF INDIA, Andhra Univ., Waltair (India). Dept. of Geology. N. V. N. Durgaprasada Rao, and M. Poornachandra Rao. Marine Geology, Vol 15, No 3, p M43-M48, October 1973, 3 fig, 2 tab, 5 ref.

Descriptors: \*Clays, \*Trace elements, \*Continental shelf, \*Metals, Distribution patterns, Clay minerals, Adsorption, Provenance, Organic matter, Copper, Chromium, Cobalt, Nickel, Lead, Zinc. Molybdenum, Strontium. Identifiers: \*India, Barium, Boron, Tin, Germanium, Gallium, Vanadium,

Thirty continental-shelf clays sampled off the east coast of India were analyzed spectrographically to determine the concentrations of Ge, Ga, Pb, Cu, Mo, Sn, V, Ni, Co, Zr, Cr, Ba, Sr, and B. Most of these elements are detrital in origin and are primarily held in clay minerals or adsorbed onto the clays in the nearshore mixing zone. Organic matter influences the concentrations of Ge, Sn, and to a lesser extent, Ga and Pb in the shelf. (Knapp-USGS) W74-03350

STRUCTURE AND TEXTURE GRAVELLY BARRIER ISLAND IN THE FIT-ZROY ESTUARY, WESTERN AUSTRALIA, AND THE ROLE OF MANGROVES IN THE

SHORE DYNAMICS, Australian National Univ., Canberra. Dept. of Biogeography and Geomorphology.
For primary bibliographic entry see Field 02L. For primary W74-03351

OXYGEN AND CARBON ISOTOPE COMPOSI-TIONS OF ALTARED CARBONATES FROM THE WESTERN FACIFIC, CORE 53.0, DEEP SEA DRILLING PROJECT,
Illinois Univ., Urbana. Dept. of Geology. T. F. Anderson.

Marine Geology, Vol 15, No 3, p 169-180, October 1973. 1 fig. 3 tab, 43 ref.

Descriptors: \*Limestones, \*Diagenesis, \*Weathering, \*Igneous rocks, Water chemistry, Pore water, Sea water, Connate water, Oxygen isotopes, Carbonate rocks, Pacific Ocean, \*Car-Identifiers: Volcanic rocks.

In the lower part of Deep Sea Drilling Project core no. 53.0, partly recrystallized carbonate sediments and well recrystallized limestone breccias of Oligo-Miocene age are associated with altered vol-canic flows, lithified tuffs, and tuff breccias, suggesting that carbonate alteration was the result of thermal metamorphism. However, the oxygen isotope compositions of these carbonates are not compatible with recrystallization and isotope exchange with seawater at high temperatures. The exchange with seawater at high temperatures. In efollowing approximate maximum temperatures of recrystallization were calculated: limestone breccias, 100 deg C; calculated teveins rimming breccias, 130 deg C; and unconsolidated sediments overlying the breccias, 20 deg C. Therefore, the volcanics at site 53.0 must have been emplaced into the primary carbonate sediments at relatively low temperatures. Subsequent carbonate alteration was probably a consequence of chemical changes in ambient pore waters resulting from the submarine weathering of volcanic material. (K-napp-USGS) W74-03352

AN INSTRUMENTATION SYSTEM TO MEASURE NEAR-BOTTOM CONDITIONS ON THE

Washington Univ., Seattle. Dept. of Oceanog-R. W. Sternberg, D. R. Morrison, and J. A.

Trimble.

Marine Geology, Vol 15, No 3, p 181-189, October 1973. 5 fig, 1 ref.

Descriptors: \*Instrumentation, \*Current meters, \*Continental shelf, Sediment transport, Currents (Water), Sedimentation, Photography, \*Pacific

An instrumentation system was designed for use in measuring currents on the floor of the continental shelf. It can remain submerged for periods of one month continuously recording water speed and direction 1 m from the seabed, differential pressure, and bed nature by means of half-hourly photographs. Four of these systems are presently in use in arrays across the continental shelf of Washington. Over 35 tests were made to depths ranging from 20 to 175 m and for periods of hours to four weeks. The combination of current-meter data and bottom photographs clearly illustrates the nature of the bed, the relationship between sediment movement and the velocity 1 m off the bed, and the mode of transport (suspended load). (Knapp-USGS) W74-03353

TIME-INTERVAL PHOTOGRAPHY OF LITTORAL PHENOMENA,
Army Coastal Engineering Research Center,
Washington, D.C. Engineering Development Div.
D. W. Berg, and E. F. Hawley.
Reprint No 9-73, Reprinted from Proceedings of

13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 39, p 725-745, 1972. 11 fig. 1 tab, 10 ref, append.

Descriptors: \*Data collections, \*Beaches, \*Coastal engineering, \*Photography, \*Beach erosion, Waves (Water), Surf, Sedimentation, Sediment transport. Shores, Coasts, \*California Identifiers: Time-lapse photography.

An approach to minimize the need for personnel in collecting data on littoral phenomena involves the use of a photographic technique, using time-interval cinematography. Two such systems were tested at Point Mugu and Newport Beach, Califor-nia. This method incorporates commercially available 16 mm motion picture cameras with auto matic lenses, remotely programmed to shoot selected lengths of film at predetermined periods during a day, every day. At Point Mugu the camera, housed in a weatherproof enclosure mounted atop an existing 100-foot tower, records oreline conditions, wave characteristics and existing weather twice a day for a period of 20 seconds per exposure. The cameras are normally serviced on a weekly basis but are capable of longer unattended operation. (Knapp-USGS) W74-03364

CHARACTER AND STABILITY OF A NATU-RAL TIDAL INLET,
Army Coastal Engineering Research Center,
Washington, D.C.

For primary bibliographic entry see Field 02L. W74-03365

DIEGO, CALIFORNIA, Moffat and Nichols, Long Beach, Calif. For primary bibliographic entry see Field 08B. W74-03366 CASE HISTORY OF MISSION BAY INLET. SAN

A GROSS LONGSHORE TRANSPORT RATE

Army Coastal Engineering Research Center, Washington, D.C. Coastal Processes Branch. C. J. Galvin, Jr.

Reprint No 12-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 50, p 933-970, 1972. 5 fig, 2 tab, 42 ref.

Descriptors: \*Littoral drift, \*Suspended load, Equations, Coastal engineering, Sediment transport, Surf, Waves (Water), Currents (Water).

Gross longshore transport rates for 11 long-term field measurements are predicted reasonably well by an empirical relation relating longshore trans-port rate to mean breaker height. A physical ex-planation of this empirical relation assumes that most littoral drift is transported in suspension, and that the empirical relation is an equation for con-servation of suspended sediment in the longshore current. (Knapp-USGS) W74-03367

SUSPENDED SEDIMENT AND LONGSHORE SEDIMENT TRANSPORT DATA REVIEW, Army Coastal Engineering Research Center, Washington, D.C. M. M. Das.

Reprint No 13-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 54, p 1027-1048, 1972. 7 fig. 47 ref.

Descriptors: \*Suspended load, \*Surf, \*Waves (Water), \*Littoral drift, Sediment transport, Turbulence, Turbulent flow, Coastal engineering,

Studies of suspended sediment under waves are reviewed. Although about five analytical or semiempirical approaches have been attempted to pre-

### Group 2J-Erosion and Sedimentation

dict the vertical distribution of suspended sediment, none of the approaches has had its general validity proven. This is mainly due to the lack of knowledge about the characteristics of turbulence of the wave boundary layer and to the lack of a suitable suspended sediment measuring technique for use in waves. An optical system shows promise in obtaining information on the mechanics of suspension under waves. Turbulence is the major cause of suspension of sediment in a turbulent flow. The only source of turbulence under waves is the boundary layer, except near breakers. (Knapp-USGS) W74-03368

LONGSHORE TRANSPORT OF SUSPENDED

SEDIMENT,
Army Coastal Engineering Research Center,
Washington, D.C.
J. C. Fairchild.

Reprint No 17-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 56, p 1069-1088, 1972. 13 fig. 9 ref.

Descriptors: \*Suspended load, \*Surf, \*Littoral drift, Sands, Beaches, Sampling, Sediment transport, Waves (Water), Coastal engineering, New Jersey, North Carolina.

Suspended sediment samples were collected from stations along the City Pier, Ventnor, New Jersey, and Jennettes Pier, Nags Head, North Carolina. Most samples were collected within the surf zone at the Ventnor site. At the Nags Head site sample collections included the surf zone, but generally extended over a wider range of the nearshore zone. Collection elevation varied from 3 inches above the bottom up to a maximum at about middepth, generally not greater than 2.5 feet above bottom. Maximum concentrations at Ventnor ranged up to 2.6 ppt by weight and at Nags Head were about 4.0 ppt. Median size at Ventnor ranged from 0.12 to 0.15 mm and averaged about 0.20 mm in depths of 4 feet and less at Nags Head. Averages of surf zone concentration in waves up to 4 feet high show significant variation in concentration with elevation above the bottom. The higher the level of wave activity the less concentration varies with elevation above bottom, and hence the flatter the trend in the distribution curve. For waves approaching their breaking depth, the concentration of suspended sediment rises sharply just before the wave breaks, peaking at a wave height-to-water depth ratio of about 0.78 (theoretical breaker index). Concentration then drops off more slowly shoreward of the initial wave breaking. Median size of the suspended sediment samples decreases gradually with increase in water depth and with increase in sampling elevation above the ocean bottom. There is some implication that a flatter distribution of sand size with height, as found in the smaller size Ventnor sand, may be indicative of higher concentrations for smaller more uniformly mixed sands. (Knapp-USGS) W74-03369

STATE OF GROIN DESIGN AND EFFECTIVE-

NESS, Army Coastal Engineering Research Center, Washington, D.C. Evaluation Branch. For primary bibliographic entry see Field 08A. W74-03370

REMOTE SENSING IN THE STUDY OF COASTAL PROCESSES,

Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 07B. W74-03373

COASTAL APPLICATIONS OF THE ERTS-A SATELLITE.

Army Coastal Engineering Research Center, Washington, D.C.

O. T. Magoon, D. M. Pirie, and J. W. Jarman. Reprint No 18-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 117, p 2065-2073, 1972. 4 fig. 3 ref.

Descriptors: \*Remote sensing, \*Coasts, \*Satellites (Artificial), Coastal engineering, Waves (Water), Sedimentology, Sedimentation, Shoals, Erosion, Beach erosion, Turbidity, Currents Identifiers: ERTS-A

The Earth Resources Technology Satellite (ERTS) was placed in orbit in July 1972. ERTS imagery will be of use to coastal investigators in two principal areas: study of coastal sediment and related water mass movement through the repeated monitoring of coastal sediment plumes, and for the study of changes in highly variable sections of coasts such as offshore barrier islands and erodible shoals. Use of ERTS imagery in studies relating to deep water wave direction is problematical depending on the resolution of water surface waves. (Knapp-USGS)

THE RELATIONSHIPS BETWEEN WIND RECORDS, ENERGY OF LONGSHORE DRIFT, AND ENERGY BALANCE OFF THE COAST OF A RESTRICTED BODY OF WATER, AS AP-PLIED TO THE BALTIC,

Kiel Univ. (West Germany). Geologisch-Palaeontologisches Institut und Museum.

Marine Geology, Vol 4, No 2, p 119-147, April 1966. 19 fig, 15 ref.

Descriptors: \*Coasts, Winds, \*Waves (Water), \*Forecasting, \*Littoral drift, \*Sediment transport. Identifiers: Longshore drift, Energy balance, Drift energy, \*Baltic Sea.

An attempt is made to derive from wind records the intensity of the longshore drift. Based upon the fundamentals of modern wave forecasting and knowledge of the relative efficiency of different angles of wave approach, the yearly course of drift energy is calculated for four points on the coast of Schleswig-Holstein (western coast of the Baltic). By subdividing the wind records into four classes of strength, four patterns of drift energy related to distinct zones of water depth are presented. A comparison of the drift energy calculated for three neighboring points permits a derivation of energy balance for the central point. The knowledge of the patterns of both drift energy and energy balance allows insight into the mechanism of the longshore drift. Until the present time, however, the quantitative relationships between drift energy and true volume of material transported thereby are still unknown. To avoid disturbing influences of distant wave patterns the energy cannot be calculated in the manner applied here, the method presented is valid only for a restricted area, i.e., the magnitude of the more or less uniform wind field should be similar to that of the corresponding marine area. (Sinha - OEIS) W74-03431

BEACH CHANGES, ON THE CENTRAL TEXAS COAST ASSOCIATED WITH HURRICANE FERN, SEPTEMBER, 1971, Western Michigan Univ., Kalamazoo. Dept. of

Geology. R. A. Davis, Jr.

Texas University Contributions in Marine Science Vol 16, p 89-98, 1972. 5 fig, 10 ref.

Descriptors: "Texas, "Beach erosion, "Hurricanes, Barrier islands, "Wind velocity, "Storms, Tides, "Wind tides, Sedimentation. Identifiers: Beach profiles, Swash bars, Lowenergy environments.

Hurricane Fern crossed the central Texas barrier island system on September 10, 1971, imparting a considerable amount of physical energy on g beaches. Beach erosion caused pronounced changes in profile configuration. The volume of sediment removed was at least as much as that removed by Hurricane Celia the year before, even though the wind velocity during Celia was three times that of Fern. Partial recovery of the beaches began several days after passage of the storm with shoreward migration and welding of small swash bars. The following general statements are ap-propriate for hurricane generated beach changes: (1) The total volume of sediment loss resulting from such a storm is large and accounts for most of the longterm erosion along the relatively low energy barrier island beaches of central Texas. (2) The rate of movement of the storm is one of the most significant factors in beach erosion. Slow moving storms generate large waves and high storm tides which are the most important factors in beach erosion. (3) Post-storm recovery of the beach is quite slow and may not be completed before the next severe storm arrives. (Sinha - OEIS) W74-03433

THE OLD COASTLINE OF THE WASH, Hydraulics Research Station, Wallingford (England). For primary bibliographic entry see Field 02L. W74-03435

SIZE DISTRIBUTIONS OF THE SUSPENDED PARTICLES OF THE CHESAPEAKE BAY TURBIDITY MAXIMUM, Johns Hopkins Univ., Baltimore, Md. Chesapeake

Bay Inst. For primary bibliographic entry see Field 02L. W74-03436

DYNAMIC CHARACTERISTICS OF WEST FLORIDA GULF COAST BEACHES, University of Southern California, Los Angeles. Dept. of Geology. D. S. Gorsline.

Marine Geology, Vol 4, p 187-206, 1966. 16 fig, 5

Descriptors: \*Florida, Gulf Coastal Plain, \*Sediment transport, Waves (Water), \*Beaches, Currents (Water) Identifiers: \*Longshore currents, \*Wave energy.

During 1962 fifteen beach stations were established along the Florida coast and monitored at monthly intervals. Observations of beach profiles, sediments, wave conditions, water characteristics and wind speed and direction were recorded. Techniques closely followed those of a nearly contemporaneous study on California beaches (Ingle, 1966). This made possible a com-parison of beach conditions in a low- and medium-energy environment (Florida) with a high-energy environment (California). Average wave condi-tions in Florida range from low ripples in the low-energy eastern segment near Keaton Beach, to over 30 cm wave height along the broad arc from Cape San Blas to the Alabama-Mississippi peri-delta region. Maximum wave heights reach 100 cm and more along the Pensacola shore and approach the average condition for high-energy beaches. Longshore current velocities, however, are surprisingly constant and range from 30 to 150 cm/sec in the general area. The much larger waves of the California coast produce essentially the same range of current velocities. This is a function of the increase in dimensions of a surf zone as larger waves necessarily break farther offshore, thus the

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larger amount of water moved in translation is nced by the increased area. Statistical studies of the sediment textural parameters confirm the observations of Schiffman (1965) regarding the greater variation in texture occurring in the swash zone than in other parts of the beach system. Net sand transport is to the west and apparently is actively prograding the large spits of the area from Mobile Bay to Pensacola. Wave energy decreases west of Mississippi Sound and transport diminishes. (Sinha - OEIS) W74-03437

TABASCO BEACH-RIDGE PLAIN: AN EROD-ING COAST,
Florida State Univ., Tallahassee, Dept. of Geolo-

W. F. Tanner, and F. W. Stapor.

Transactions Gulf Coast Association of Geological Societies, Vol 21, p 231-232, October 1971. 1 fig, 4

Descriptors: \*Beaches, \*Erosion, Shallow water, Littoral, History, \*Mexico, Coasts. Identifiers: \*Tabasco (Mex), Beach-ridges.

The beach-ridge plain in the State of Tabasco, Mexico, is undergoing erosion today. It has not been growing for at least 50 years, and perhaps for as long as several centuries. Ten lines of evidence, including some severe limiting dates, substantiate this analysis. The large number of beach ridges, however, provides that, prior to the present however, provides that, prior to the present epoch, there was a long interval of growth. The area has gone through a late Holocene history hav-ing 2 main parts: (1) a littoral economy of abundance of sand, during which the beach-ridge plain was built; and, (2) a littoral economy of scarcity of sand, during which the edge of the plain has been attacked by erosion. This history coincides with that of other beach-ridge plains in North and South America. The equilibrium beaches of the world have undergone a shift in the last few centuries, or are now undergoing a shift, from dominant deposition to dominant erosion. The problem of essentially world-wide coastal erosion is, there-fore, getting worse. (Sinha-OEIS) W74-03441

THE COASTAL SHOALS OF WESTERN CUBA

AND THEIR DEPOSITS, Akademiya Nauk SSSR, Moscow. Institut Okeanologii.

For primary bibliographic entry see Field 02L. W74-03443

ORBITAL VELOCITY ASSOCIATED WITH WAVE ACTION NEAR THE BREAKER ZONE, Scripps Institution of Oceanography, La Jolla, Calif

D. L. Inman, and N. Nasu. Corps of Engineers Beach Erosion Board Technical Memorandum No 79, March 1956. 72 p, 40 fig, 4 tab, 18 ref, 2 append. DA49-055-eng-3.

Descriptors: \*Sediment transport, \*Beach ero-sion, \*Waves (Water), \*Coasts, Shallow water, sion, \*Wave \*California.

Identifiers: \*Breaker zone, \*Solitary waves, Orbital velocity, Water depth.

The orbital velocity associated with ocean surface waves in shallow water was measured for various wave conditions at La Jolla, California, as part of a program of study of sand transport and beach erosion. The measurements were made near the bottom and just seaward of the breaker zone in water depths ranging from about five to fifteen feet and for wave heights as great as seven and one-half feet. The current measuring device consisted essentially of a cylindrical rod fixed rigidly at one end like a cantilever, and the system was so arranged that the orbital velocity could be in-terpreted from the bending of the rod caused by

the force exerted by the moving water. Orbital velocity and wave pressure were recorded simultaneously for time intervals of about twenty minutes. The observed maximum horizontal velocities compare favorably with velocities predicted from solitary wave theory for most waves with simple profiles when the ratio of the wave height to water depth is greater than about 0.4. The agreement with theory is somewhat better for longer period waves, and in some cases is still quite good in regions where the ratio of wave height to water depth is less than about 0.2. On the average, the onshore velocity associated with the passage of a wave crest was greater in magnitude and of shorter duration than the offshore velocity and or shorter duration than the offshore velocity under the wave trough. The differences in crest and trough velocities varied from wave to wave, but in general correlated with the shape of the waves. (Sinha-OEIS)
W74-03444

VARIATIONS PROFILES ALONG THE OUTER BANKS OF NORTH CAROLINA,

Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

Shore and Beach, Vol 33, No 2, p 22-26, October 1965. 4 fig, 1 tab, 2 photos. Nonr 1575 (03).

Descriptors: \*Beaches, \*Waves (Water), \*Tidal effects, Profiles, Seasonal, \*Berms, Energy, North Carolina.

Identifiers: Outer Banks (NC), Bodie Island (NC), Surf zone, \*Littoral currents, Swell, Wave ac-

During the past three years the Coastal Studies In-stitute of Louisiana State University has conducted a series of detailed beach-process experi-ments on the Outer Banks of North Carolina. These studies were undertaken to investigate relationships between surf-zone processes and the sedimentary and morphologic characteristics of a natural beach. Specifically, continuous measurements over a six-month period were made of beach sand levels, wave properties, tidal action, and littoral currents. The Bodie Island beaches respond inversely to the hydraulic forces of wave action. Higher waves with shorter periods are as-sociated with reduction in beach 'thickness' and slopes, and lower waves with longer periods result in thicker and steeper beaches. December through February is the season of highest beach variability. This is indicated by the wide range of maximum-Inis is indicated by the wide range of maximum-minimum values and in the wave data. The waves were higher than 5 feet for 25 per cent of the time and had shorter periods. March and April are months of relatively high energy equilibrium, and the May profile approaches typical berm. It seems probably that a profile similar to that of May will extend into the summer with little change. It may be concluded, therefore, that the beaches of coastal North Carolina are cyclic in nature, building seaward during summer and retreating in response to winter conditions. (Sinha-OEIS) W74-03446

THE POSSIBILITY OF CALCULATING THE SAND DRIFT ALONG A SHALLOW-WATER COASTT. II. DEFINITION OF THE BASIC CON-CEPTS AND TERMS AND FORMULATION OF THE PROBLEM OF DETERMINING THE DRIFT, V. V. Longinov.

Oceanology, Vol 5, No 3, p 69-76, May 1966. 3 fig,

Descriptors: \*Sediment transport, \*Littoral drift, \*Discharge (Water), Erosion, Deposition (Sediments), \*Coasts, \*Shallow water. Identifiers: Near shore.

The term drift is applied to the continuous move-ment of material in the same direction. The ex-

istence of a single drift or a sequence of drifts has as its results the ultimate displacement of material through some section of the nearshore zone. The differential characteristic of the drift is its discharge. The first step in determination of discharge is to clarify the function that relates discharge to the characteristics of the force flux. Such a function should include dependence on these characteristics of the intensity of erosion and the rate of transport of erosion products along the coast. The first relationship (for erosion should, in its turn, contain two functions--the dependence of transverse or normal erosion defined by the p sub x function, and the dependence of erosion on the longshore component of the flux.

The next stage should be to clarify the structure of the flow that determines the discharge. By the accepted terminology the concept of flow structure includes the structure of the discharge and its kinematic structure and material composition. structure of the discharge may be expressed, for example, by the relationship between the discharge of suspended matter and the total discharge or it may be a more differentiated characteristic, in relation to the detail attempted in describing the movement of material in the flow problem. Material composition may be described in the form of the dependence of the ordinary lithological characteristics of the material on the coordinates. (Sinha-OEIS) e requirements and conditions of the

FALLING WATER LEVEL RIPPLE MARKS, Florida State Univ., Tallahassee. Dept. of Geolo-

For primary bibliographic entry see Field 02L. W74-03449

THE COASTAL ENVIRONMENT OF NEW EN-

Geological Survey, Woods Hole, Mass. For primary bibliographic entry see Field 02L.

WATER WAVES FROM UNDERWATER EX-PLOSIONS IN SHALLOW WATER, PART I: A MATHEMATICAL MODEL FOR WAVES IN CONSTANT DEPTH AND IN SHOALING WATER, Naval Civil Engineering Lab., Port Hueneme,

Calif For primary bibliographic entry see Field 02L.

W74-03454

THE EFFECT OF CURRENTS ON THE MASS TRANSPORT OF PROGRESSIVE WATER

National Engineering Science Co., McLean, Va. For primary bibliographic entry see Field 02L. W74-03455

CONDITIONS OF BEACH RETROGRESSION IN A LOW-ENERGY ENVIRONMENT, Florida State Univ., Tallahassee. D. A. Warnke.

Zeitschrift fur Geomorphologie, Vol 11, No 1, p 47-61, March 1967. 7 fig, 3 tab, 13 ref.

Descriptors: \*Coasts, \*Beach erosion, \*Florida, \*Storms, \*Hurricanes, \*Storm surges, Meteorology, Environmental effects.
Identifiers: Low-energy environmental

Identifiers: Low-energy environments, Breaker heights, Beach retrogression, Air-sea interaction.

During repeated surveys of several sites on Alligator Spit in the Big Bend area of Florida, it became tor Spit in the Big Bend area of Fiorida, it became apparent that the beach was rapidly retrograding. This seemed anomalous because the area of Alligator Spit had been classified by Tanner (1960) as a low energy environment, defined by average annual breaker height of less than 10 cm. The rate of

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retrogression of those beaches was in excess of 6m per year which was as great or greater, than those of many retrograding high energy beaches. This rate is considerably greater than postulated by Tanner (1964) for exposed beaches on nearby St. Vincent and St. George Islands, namely one meter per year. Because of this difference, it was decided to continue the surveys of one site, FSU No. 5, and to 'bracket' them as closely as possible around the occurrences of hurricanes. Such occurrences naturally seemed to accelerate erosion, but it was not known to what degree. It was also not known whether this beach loss was permanent or was compensated by prograding of the beach during times of quiescence. Rapid beach retrogression in a low energy environment is entirely possible, is not 'catastrophic' in a geologic sense, and is caused by air-sea interaction phenomena which are only partially understood and cannot be pre-dicted accurately. Therefore, development of such beach areas should be discouraged until meteorologists and coastal engineers develop better methods for surge predictions and protection. (Sinha-OEIS) W74-03456

EQUILIBRIUM BEACH PROFILE SCALE-MODEL RELATIONSHIP.

Tetra Tech, Inc., Pasadena, Calif.

E. K. Noda

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol 98, No WW4, Proceedings paper 9367, p 511-528, November 1972. 8 fig, 1 tab, 14 ref, 2 append. DACW 72-70-C-0021.

\*Coasts \*Beaches \*Profiles Descriptors: \*Equilibrium, \*Model studies. Identifiers: Similitude relations, Scale models

The purpose was to develop a scale-model law from laboratory beach profiles assumed to be at equilibrium. Consideration is given to similitude relations and to possible coastal movable-bed model laws. Experimental data and analysis are presented. The model law has been derived from two-dimensional laboratory beach profile data and thus the extrapolation to three-dimensional models is still in question. Optimistically, this model should be applicable to prototype beaches which are reasonably approximated by two-dimensions. With scaling of the wavelength by the vertical scale the refraction pattern is preserved, which offers credibility to three-dimensional extrapolation, but the number of waves in the model when scaled to prototype dimensions will be smaller in proportion to the distortion. The region of interest was the beach profile in the breaker zone where the boundary conditions should be based on turbulent flow characteristics. The offshore zone boundary conditions are viscous dominated and thus are not compatible with those of the breaker zone. From a practical viewpoint the breaker zone is more important, and from the experimental results, the offshore boundary conditions do not affect the breaker zone beach profiles. (Sinha-OEIS) W74-03457

BEACH CUSPS: RESPONSE TO PLATEAU'S

California Univ., Los Angeles. Dept. of Geology. P. E. Cloud, Jr.

Science, Vol 154, No 3751, p 890-891, November 18, 1966. 1 fig, 8 ref.

Descriptors: \*Topographic features, Beaches, \*Sediments, \*Waves (Water), Coasts, \*Shallow

Identifiers: \*Beach cusps, \*Wave height.

Beach cusps familiar to many frequenters of sherelines, occur along beaches that lie parallel with the approaching wave train. Characteristically, they appear (in plain view) as a remarkably evenly spaced, linear array of symmetric sinusoidal or deltoidal 'horns,' or low mounds, of seaward-projecting sediment, separated by equally symmetric crescent-shaped depressions, concave toward the sea. The beach sediment is commonly coarser on the cusps than in the intervening depressions between them. Cusps develop during recession of the water level characteristically following storms, but also with falling tides. The all-too-few observations are consistent with but do not prove the hypothesis that beach cusps form in response to the nearly regular segments tion of the cylindrical wave form against the beach, as predicted from Plateau's rule, but with local complications due to hydrodynamic variations and beach regimen. If this hypothesis were true, the average spacing of beach cusps would reflect the height of the waves that produced (or is producing) them--a relation that, if it could be expressed more precisely, would contribute to the synoptic study of coastal conditions. (Sinha-OEIS) W74-03460

DYNAMICS AND MORPHOLOGY OF THE

SAMBIAN PENINSULA,
Akademiya Nauk SSSR, Kaliningrad. Institut
Okeanologii.

V.R. Boynagryan.
Oceanology, Vol 6, No 3, p 374-380, February 1967. 5 fig, 16 ref.

Descriptors: \*Beach erosion, \*Unconsolidated sediments, Coasts, Dunes, \*Glacial drift, Erosion, Storms, \*Storm surge, Landslides, Ice, \*Topog-

raphy.
Identifiers: \*Baltic Sea (Sambian Peninsula), Slumping.

The Sambian Peninsula consists of a variety of un-consolidated deposits. The coasts are mainly Quaternary moraine loams and clavs with sand Quaternary morane loams and clays with sand lenses and sand, gravel and shingle deposits. In places, however, there are also outcrops of Tertia-ry sands and sandy clays. The outcrops of the moraine form prominences on the coast. Large and small boulders washed out of the moraine have formed accumulations at the cliff foot and on have formed accumulations at the cliff foot and on the submarine beach slope. Where unconsolidated and readily eroded Tertiary sands and sandy clays outcrop, gently flowing indentations of the coast have formed. An exception is provided by the large coastal prominence between Donskoye and Yantarnyy on the western coast of the Sambian Peninsula, which is apparently connected with the greatest height of the cliff and the lesser slope of the bottom than on adjacent stretches. There is an intimate connection between abrasion on the Sambian Peninsula and cyclonic activity. In years of intensive cyclonic activity the frequence and strength of the storms are both increased, and there are high storm surges. This reactivates the processes of coastal destruction and stimulates processes of coastal destruction and sumulates landslides and slumping. Considerable erosion was produced on the northern shores of the Sambian Peninsula in October 1963 by a force 6 northwesterly storm. The sands overlying the moraine around the mouths of the Aleyka and the Zabava were eroded for 5-6 m. A force 6 north and northeasterly storm in February 1962 accompanied by a 65-70-cm surge, produced considerable destruction along the entire perimeter of the northern shores of the Sambian Peninsula. The destructive effect of the storm was intensified by the mechanical action of ice on the coast. (Sinha-OEIS) W74-03462

FORCED FLOW PASSAGES IN KARST MAS-SIFS,

Genoa Univ. (Italy). Inst. of Geography. G. Pasquini.

Transactions of the Cave Research Group of Great Britain, Vol 15, No 2, p 89-90, June 1973. 6 ref.

Descriptors: \*Karst hydrology, \*Erosion, Limestones, Water chemistry, Carbonates, Car-

bon dioxide, Groundwater movement, Caves,

A horizontal or a sloping karst gallery which is roughly circular in cross section and which maintains this outline for a clearly observable distance, is usually called a forced flow passage, meaning a passage formed by water under pressure progressively boring through the rock. This interpretation is usually incorrect, because an increase in the pressure of a mass of water within a karst massif leads to increase in the solubility of CO2, and hence reduces the amount of CO2 available to attack the surface of the rock; this should diminish rather than accentuate the erosive action. The forced flow or phreatic passages can be formed only in the upper part of the phreatic zone and, since these waters flow towards peripheral resurpassages can be formed. (Knapp-USGS) W74-03513 gences, only horizontal or moderately sloping

SOME CALCULATIONS OF THE DENUDA-TION RATE IN A DOLOMITIC LIMESTONE AREA AT ISFJORD-RADIO, WEST-SPITZBERGEN,

Lund Univ. (Sweden). Dept. of Physical Geography. U. Hellden.

Transactions of the Cave Research Group of Great Britain, Vol 15, No 2, p 81-87, June 1973. 4 fig, 1

Descriptors: \*Erosion, \*Karst, \*Karst hydrology, \*Erosion rates, Carbonate rocks, Arctic, Subsurface drainage.
Identifiers: Spitzbergen.

Corrosion analyses of karst were made at Isfjord-Radioa, West-Spitzbergen, in August 1972. To obtain the overall lowering rate, Corbel's formula, slightly modified by Williams, was used. The denudation rate was also obtained by calculating the water discharge and the chemical mass. The result of the analyses is an overall lowering rate of 11.3 mm/1000 years. (Knapp-USGS) W74-03514

APPARATUS FOR AUTOMATIC CONTROL OF SEDIMENT LEVEL (PRIBOR DLYA AVTO-MATICHESKOGO KONTROLYA UROVNYA OSADKA), Ukrainski Nauchno-Issledovatelskii Institute Bu-

magi, Kiev (USSR).

For primary bibliographic entry see Field 05D. W74-03541

RADIOISOTOPIC SAND TRACER STUDY POINT CONCEPTION, CALIFORNIA. PRELIMINARY REPORT ON ACCOMPLISH-MENTS JULY 1966 - JUNE 1968, Army Coastal Engineering Research Center, Washington, D.C.

D. B. Duane, and C. W. Judge.

Available from NTIS as AD-690 804, \$6.00 in paper copy, \$1.45 in microfiche. Miscellaneous Paper No. 2-69, May 1969. 201 p, 55 fig, 4 tab, 154 ref, 6 append. AEC AT (49-11)-2988.

Descriptors: \*Sediment transport, \*Tracers, \*Radioactivity techniques, \*Beach erosion, \*California, Radiation, Tagging, Littoral, Computer programs.

Identifiers: Point Conception (Calif), \*Nearshore processes, Xenon 133.

The purpose is to develop and use radioactive tracers for research in sand movement and littoral processes. Objectives include determination of suitable radioactive isotopes, development of radiation detectors, and development of handling and survey programs. Concurrent with these objectives, studies of sediment transport around the Point Conception headland and of the mechanics of littoral transport are being conducted. Methods developed by this program have direct application to engineering design of such works as harbor development and beach erosion prevention, and quasi-military application such as the location of radioactive or other toxic materials. Sand grains indigenous to the study area have been labeled with xenon-133 which does not adversely affect the hydraulic properties of the sand. A mobile detector system using cesium iodide crystals and housed in a 'ball' towed behind an amphibious vehicle detects quantity and areas of radiation. Computer programs correct and plot radiation data. A field test of equipment and principles at Cape Kennedy, Florida, was successful. Additional field tests were at Surf and Point Conception, California. (Sinha-OEIS)

TOPOGRAPHIC CHANGES IN THE SURF ZONE PROFILE, Louisiana State Univ., Baton Rouge. Coastal Stu-

Louisiana State Univ., Baton Rouge. Coastal St dies Inst.

C. J. Sonu, and R. J. Russel.

Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, Sept 1966, American Society of Civil Engineers, Vol 1, Part 2, Chap 31, p 502-524, 1967. 17 fig, 28 ref. Technical Report No. 50, Sept. 1966. Nonr-1575 (03).

Descriptors: Shores, Topography, \*Waves (Water), \*North Carolina, Profiles, \*Beaches, \*Shallow water.

Identifiers: \*Surf zone, Nearshore, Outer Banks (NC).

The conventional method of dealing with relationships between wave action and topographic response on a beach is to reduce the problem to a two-dimensional scheme that regards basic processes as taking place in a vertical plane normal to the shoreline. This scheme is valid only if the waves arrive at right angles to the shore and the nearshore contours are reasonably straight and parallel the beach. As these conditions are not realized in many cases another analytical method is necessary - one that recognizes effects of other than normal wave arrival and systematic patterns of diversification in nearshore topography. This study, based on a long period of field investigation on the Outer Banks, North Carolina, examines a three-dimensional approach. Observations from a long pier were used to explain nearshore topographic diversification and resulted in conclusions that were confirmed by subsequent field observation. (Sinha-OEIS) W74-03609

THE ROLE OF SHELL MATERIAL IN THE NATURAL SAND REPLENISHMENT CYCLE OF THE BEACH AND NEARSHORE AREA BETWEEN LAKE WORTH INLET AND THE MIAMI SHIP CHANNEL,

MIAMI SHIP CHANNEL, Miami Univ., Fla. Marine Lab. For primary bibliographic entry see Field 02L. W74.0361.

BED FORMS GENERATED IN THE LABORA-TORY UNDER AN OSCILLATORY FLOW: ANALYTICAL AND EXPERIMENTAL STUDY, Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 08B. W74-03612

ON SINGULAR BOUNDARY VALUE PROBLEMS FOR THE EPD EQUATION, Wisconsin Univ., Madison. Dept. of Mathematics. For primary bibliographic entry see Field 02E. W74-03617

PROCESSING AND ANALYSIS OF RADIOISOTOPIC SAND TRACER (RIST) STUDY DATA, Oak Ridge National Lab., Tenn.

Oak Ridge National Lab., Tenn. H. R. Brashear, E. H. Acree, F. N. Case, P. A. Turner, and D. B. Duane.

Available from NTIS as AD-732 608 for \$3.00 paper copy, \$1.45 microfiche. In: Proceedings of the Coastal Engineering Conference (12th), at Washington, D.C., September 1970, p 821-830, 1970. 7 fig.

Descriptors: \*Tracers, \*Radioisotopes, \*Sediment transport, \*Computer programs, \*Littoral, \*Consts, Shallow water, \*Beaches.
Identifiers: Nearshore processes.

Data collected during the Radioisotopic Sand Tracer (RIST) field tests are processed through digital computers. Data treatment requires computing and plotting the detector position and cor-responding radiation count rates for radioactive decay. The field data are recorded on punched paper tape which is then edited and transferred to agnetic tape for input to data reduction programs. The navigation data, which are in the form of distances to shore-based microwave responder beacons, are tested for spurious values by comparison with the theoretical maximum travel distances of the survey vehicle between succes-sive fixes. The navigation ranges are then con-verted to rectangular geographical coordinates. Present emphasis is in the development of computer programs to construct a count rate surface from data collected along track lines. This from data collected along track lines. This technique facilitates machine contouring and enables numerical integration of the count rate surface. The ultimate goal is to obtain an estimate of mean direction and volume of littoral transport and a radiation material balance to be used to check the results. Several programs required to accomplish these tasks are operating at the Coastal Engineering Research Center and the Oak Ridge National Laboratory. (Sinha - OEIS) W74-03628

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966, VOLUME I. For primary bibliographic entry see Field 08B. W74-03674

A PETROGRAPHIC STUDY ON LITTORAL DRIFT ALONG THE ISHIKAWA COAST, JAPAN.

Senshu Univ., Tokyo (Japan). For primary bibliographic entry see Field 02L. W74-03692

DEPOSITIONAL BEHAVIOR OF FINE SEDI-MENT IN A TURBULENT FLUID MOTION, Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.

E. Partheniades, and J. F. Kennedy. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 41, p 707-729, 1967. 14 fig, 12

Descriptors: Equilibrium, \*Shear stress. \*Suspended solids, \*Flocculation, \*Turbulence. Identifiers: \*Fluid flow.

An experimental investigation, utilizing an apparatus consisting of a counterrotating annular channel and ring, of the depositional characteristics of fine, cohesive sediment revealed that after an initial period of rapid deposition, the sediment concentration approaches asymptotically an equilibrium value. The ratio of this equilibrium concentration to the initial concentration is nearly independent of initial concentration and for a given sediment and environment depends only on

the flow conditions. For the three water depths investigated, the ratio of equilibrium to initial concentration was found to be a single function of an average shear stress around the channel-section perimeter. A comparison of the size distributions of the parent material with the material retained in suspension when equilibrium was achieved indicated that the greatest losses occur in the claysize fractions, suggesting that the deposition is controlled predominantly by flocculation, and that the strength and size of the flocs exert a stronger influence on the deposition than does the particle weight. A silty-clay sediment with a mean particle diameter of 0.0009 mm was used in all experiments. (See also W74-03674) (Sinha-OEIS) W74-03697

MATHEMATICAL SIMULATION OF BOTTOM SEDIMENT MOTION BY WAVES,

National Research Council of Canada, Ottawa (Ontario). Hydraulics Section.

J. W. Kamphuis.
In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 44, p 766-789, 1967. 14 fig, 1 tab. 20 ref.

Descriptors: \*Mathematical models, Bed load, \*Waves (Water), \*Sediment transport, Coasts, Equations, Hydraulics, \*Bottom sediments. Identifiers: Wave action.

A mathematical model may be constructed to simulate bottom sediment movement under waves. This model will necessarily be subject to much empiricism. Because of the large number of calculations made, each with its own errors, it is to be expected that the accuracy of the results is not very high. This study has shown however, that the accuracy is considerably better than a classical error study would tend to indicate. In any study of sediment motion a substantial scatter is to be expected due to the inherently statistical nature of the whole problem. It is thought, however, that in this study also a large proportion of the scatter may be due to an inadequate knowledge about velocities in the boundary layer and perhaps due to too many simplifying assumptions in the evaluation of the effective water velocity, the prime moving force. Until further research is performed in this area, it is of little value to extend the mathematical model to include bottom slope, ripple formation, etc. which is mathematically not too difficult. Thus the simulation of field conditions, although mathematically quite feasible, is, at present, beyond reach until the hydrodynamics of the boundary layer becomes more clear. (See also W74-03674) (Sinha-OEIS) W74-03698

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966. VOLUME II. For primary bibliographic entry see Field 08B. W74-03699

SHORE PROTECTION ON THE COAST OF 'YAIZU',

Fisheries Agency, Tokyo (Japan). Fishing Port Div.
For primary bibliographic entry see Field 08B.
W74-03700

CHARACTERISTICS OF SEDIMENTARY EN-VIRONMENTS IN MORICHES BAY, California Univ., Los Angeles. For primary bibliographic entry see Field 02L. W74.0320.

DAMS AND BEACH-SAND SUPPLY IN SOUTHERN CALIFORNIA, California Univ., Santa Barbara. Dept. of Geology

### Group 2J—Erosion and Sedimentation

In: Papers in Marine Geology Shepard Commemorative Volume, 1964. (R. L. Miller, ed.) Chapter 9, p 154-171, 5 fig, 1 tab, 12 ref.

Descriptors: \*California. \*Beaches. \*Dams. \*Sedimentation, \*Beach erosion, Rivers, Channelization, Streams, Flood control, Seasonal, Equilibrium, Drainage, Watersheds (Basins).

Construction of dams, flood-control channels, settling basins, and the like tend to intercept sand and prevent its reaching the beaches. The possibility of such long-term loss of beach-sand supply is discussed. In southern California, the beaches typically become flatter and thinner during the winter months, often resulting in the exposure of rocks along their inshore margins. In the summer months a change in profile develops with sand being moved inshore, covering the exposed rocks and producing a steeper profile. Three seasonal changes merely shift sand back and forth without adding to the volume of the beaches. That most beaches have not advanced steadily seaward, even when sand supplies were added periodically, suggests that in most cases a state of equilibrium has been reached in which sand normally delivered to the beaches by streams is more or less matched by losses to the land or to deep water. Many of the important sand-supplying streams in southern California are affected by dams. In the case of the Santa Ana River, 96.3 percent of the drainage basin is now blocked by the Prado Flood Control Dam. Man-made alterations of drainage basins include construction of concrete-lined channels which encourage rapid runoff of water but usually carry little sand. These channels often begin at the spillway of a flood-control dam or other structure that traps sediment. The concrete channel prevents erosion of the stream channel, and in this manner it may seal off sand supplies that would have eventually reached the beach under natural conditions. As stream development proceeds and floods are prevented from carrying large volumes of sand to the beaches, a slow but continuous shrinkage of the beaches is expected. (Sinha-OFIS) W74-03708

A STUDY OF SEDIMENT DISTRIBUTION IN THE ZONE OF SHOALING WAVES OVER COMPLICATED BOTTOM TOPOGRAPHY. Chicago Univ., Ill. Dept. of the Geophysical Sciences

R. L. Miller, and J. M. Zeigler.

In: Papers in Marine Geology Shepard Com-memorative Volume, 1964. (R. L. Miller, ed.) Chapter 8, p 133-153, 10 fig, 1 tab, 17 ref, 1 append. Also issued as Woods Hole Oceanographic Inst. Contrib. No. 1203.

Descriptors: Sedimentation, Shoals, Topography, \*Sand spits, \*Massachusetts, \*Shallow water, \*Waves (Water), \*Sediment transport, Particle

Identifiers: \*Shoaling waves, Bottom topography, Cape Cod (MA), Nearshore, Breaking waves.

This study advances a line of research concerning sediment distribution and its relationship to shoaling waves. The area chosen for the field work was on the east side of Cape Cod near Highland Light.
A long submerged bar, Peaked Hill Bar, extends between Race Point and Highland. This bar is unusual in that it is not parallel to the coast but diagonal to it, being 1500 feet more or less offshore at the Race Point end and joining the shore about one-half mile northwest of Highland. The study area discussed covers the point where Peaked Hill Bar joins the beach. This area was chosen because it provided the desired complexity of nearshore topography, and higher waves. (Sin-W74-03709

### 2K. Chemical Processes

NITROGEN, AND OTHER PHOSPORUS CHEMICALS IN SEDIMENTS FROM RESER-VOIRS IN NORTH MISSISSIPPI, Mississippi Univ., University. For primary bibliographic entry see Field 05B.

W74-03213

HYDROCHEMICAL DESCRIPTION OF MOUTHS OF RIVERS FLOWING INTO THE RESERVOIR HIMICHESKAYA KHARAKTERISTIKA UST-YEV REK, VPADAYUSHCHIKH V TSIMLYAN-SKOYE VODOKHRANILISCHE), Gidrokhimicheskii Institut, Novocherkassk (IISSR)

A. S. Yakusheva, A. A. Zenin, and V. I.

Rogozhkin. In: Formirovaniye khimicheskogo sostava poverkhnostnykh vod i metody ikh analiza: Gidrokhimicheskiye Materialy, Vol 57, p 17-21, 1973. 3 fig, 2 tab, 2 ref.

Descriptors: \*Water chemistry, \*Reservoirs, \*Rivers, \*Tributaries, \*Dissolved solids, Ions, Inorganic compounds, Hardness (Water), Color, Seasonal.

\*USSR (Tsimlyansk Reservoir), Identifiers: \*Mineralization.

Rivers flowing into the Tsimlyansk Reservoir in southeast Soviet Russia differ significantly in the quantity of dissolved material. Mineralization of right-bank tributaries varies between 120 and 1 600 mg/liter and mineralization of left-bank tributaries varies between 100 and 3,800 mg/liter. Mineralization of right-bank tributaries flowing into the reservoir is 2-3 times less than mineralization of left-bank tributaries. Right-bank tributaries are characterized by high concentrations of biogenic elements. Discharge of dissolved ions into the reservoir by right-bank tributaries is 70,000 to 340,000 metric tons, and discharge of dissolved ions into the reservoir by left-bank tributaries is 130,000 to 390,000 metric tons. Total tributary discharge of dissolved ions into the reservoir varies between 3% and 13% of the dissolved-ion discharge of the Don River in upper reaches of the reservoir. (Josefson-USGS) W74-03252

SODIUM/POTASSIUM RATIO IN WATER OF THE DON RIVER (SOOTNOSHENIYE NATRIYA I KALIYA V VODE R. DONA), Gidrokhimicheskii Institut, Novocherkassk (USSR)

For primary bibliographic entry see Field 05B. W74-03253

TRACE ELEMENTS IN BOTTOM SEDIMENTS OF DNIEPER RIVER RESERVOIRS (MIKROELEMENTY V DONNYKH OTLOZ-HENIYAKH VODOKHRANILISHCH DNEPRA),

Nauk URSR, Kiev. Instytut Akademiya Hidrobiologii. Ye. P. Nakhshina.

In: Formirovaniye khimicheskogo sostava poverkhnostnykh vod i metody ikh analiza: Gidrokhimicheskiye Materialy, Vol 57, p 30-38, 1973. 1 fig, 8 tab, 32 ref.

Descriptors: \*Water chemistry, \*Trace elements, Bottom sediments, "Reservoirs, "Metals, Manganese, Zinc, Copper, Cobalt, "Organic matter, Correlation analysis, Pollutant identification. Identifiers: \*USSR (Dnieper River).

Bottom-sediment samples were collected in the Kiev, Kremenchug, Dneprodzerzhinsk, Dneprov-

skoye imeni Lenina, and Kakhovka Reservoirs in August-September 1968 to determine Mn, Zn, Cu, and Co concentrations. The principal factor governing the concentration and distribution of trace elements in bottom sediments of Dnieper River reservoirs is organic-matter content. The coefficient of correlation between Mn and organic matter is +0.8, between Zn and organic matter-+0.96, between Cu and organic matter--+0.92, and between Co and organic matter -- + 0.90. A positive correlation exists between average values of all elements. The closest relation is observed for Cu-Co, followed by Zn-Co and Zn-Cu. The reliability of these relations is very high (>99%). Coefficients of correlation for Mn-Cu, Mn-Zn, and Mn-Co are somewhat lower. Bays and gulfs whose bottom sediments contain large amounts of or-ganic matter are areas of high concentration of trace elements in all reservoirs. Concentrations of organic matter, Mn, Zn, Cu, and Co in bottom sediments of Dnieper River reservoirs are tabulated. (Josefson-USGS) W74-03254

DISTRIBUTION PATTERNS OF ORGANIC
MATTER IN RIVER WATERS OF THE
WOODED TUNDRA ZONE (ZAKONOMERNOSTI RASPREDELENIYA ORGANICHESKOGO VESHCHESTVA RECHNYKH VOD LESOTUNDROVOY ZONY), Gidrokhimicheskii Institut, Novocherkass Novocherkassk

M. P. Smirnov, and M. N. Tarasov. In: Formirovaniye khimicheskogo sostava poverkhnostnykh vod i metody ikh analiza: Gidrokhimicheskiye Materialy, Vol 57, p 39-55, 1973. 6 fig, 3 tab, 11 ref.

Descriptors: \*Water chemistry, \*Organic matter, Rivers, \*Tundra, \*Forests, Physiographic provinces, Hydrogen ion concentration, Color, Oxidation, Floods, Low flow, Water sampling. Identifiers: USSR, Mineralization.

Analysis of organic-matter distribution in river waters in the wooded tundra zone of the USSR (covering about 1.5 million sq km) was based on determinations of permanganate oxidizability in 50 water samples from 3 points in the European part of the country and in 490 water samples from 37 points in the Asiatic part. The content of organic substances in river waters of the wooded tundra of European Russia is greater than that of Asiatic Russia. Differences in the values of the ratios of organic substances to mineral substances decrease. River waters in the wooded tundra zone of Asiatic Russia are more highly mineralized. Total mineralization of river waters in the wooded tundra zone is 42% higher than in the tundra zone of the USSR. The quantity of organic substances in river waters of the two zones is practically the same. The ratios of organic substances to mineral substances in waters of the wooded tundra zone decrease during low flows. (Josefson-USGS) W74-03255

HYDROCHEMICAL DESCRIPTION AND CAL-CIUM-CARBONATE EQUILIBRIUM OF SHU-MAK CARBONATE WATERS (GIDROK-HIMICHESKAYA KHARAKTERISTIKA I KAR-BONATNO-KAL'TSIYEVOYE RAVNOVESIYE SHUMAKSKIKH UGLEKISLYKH VOD), Irkutskii Gosudarstvennyi Universitet (USSR)

N. A. Selina, V. M. Levchenko, and G. M.

Shpeyzer.

In: Formirovaniye khimicheskogo sostava poverkhnostnykh vod i metody ikh analiza:
Gidrokhimicheskiye Materialy, Vol 57, p 123-133, 1973. 5 fig, 4 tab, 20 ref.

Descriptors: \*Water chemistry, \*Water quality, \*Inorganic compounds, \*Calcium carbonate, \*Equilibrium, Carbon dioxide, Travertine, Trace elements, Water temperature, Oxidation-reduction potential, Hydrogen ion concentration, Hardness (Water), Springs, Mineral water, Water analysis, Chemical analysis, Water sampling. Identifiers: \*USSR (Shumak River), Mineraliza-

The chemical composition of Shumak carbonate waters in Eastern Sayan (Buryat ASSR) is of the calcium-magnesium bicarbonate type, and their calcium-magnesium olcaroonate type, and their mineralization varies between 0.91 g/liter and 2.50 g/liter. Concentrations of HC03, Mg, S04, and Na+K2 increase with increasing mineralization. Processes participating in formation of the chemical composition of waters of Shumak springs include solution of carbonates and sulfates and oxidation of sulfides in the presence of a large amount of carbon dioxide. All Shumak waters are supersaturated by CaC03, as a result of which travertine forms at the point of discharge of springs at the surface. Results of a chemical analysis of samples of Shumak carbonate waters collected on June 30, 1970, and characteristics of calcium-carbonate equilibrium of Shumak mineral waters in June 1970 are tabulated. (Josefson-USGS) W74-03256

CHANGES IN CHEMISTRY OF NATURAL WATERS OF CULTIVATED LANDS (IZ-MENENIYA KHIMIZMA PRIRODNYKH VOD KULTURNYKH LANDSHAFTOV),

Akademiya Nauk SSSR, Moscow. Institut Geografii.

For primary bibliographic entry see Field 05B. W74-03257

ROLE OF PRESENT-DAY WATERS IN THE KARSTIFICATION OF CARBONATE ROCKS ON THE CRIMEAN LOWLAND (ROL' SOVREMENNYKH VOD V ZAKARSTOVANII KARBONATNYKH POROD RAVNINNOGO V. P. Meleshin

Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 3, p 84-88, May-June 1973. 1 fig, 2 tab, 18 ref.

Descriptors: \*Karst, \*Karst hydrology, \*Carbonate rocks, Calcium carbonate, Aqueous solutions, Solubility, Equilibrium, Precipitation (Atmospheric), Saline lakes.

Identifiers: \*USSR (Crimean Lowland),

Mineralization, Karst forms.

Atmospheric precipitation is the most active agent in present-day karstification of carbonate rocks on the Crimean Lowland. Floodwater and sea water have a much lesser corrosive effect. Solubility of CaCO3 in highly mineralized solutions of saline lakes depends on the concentration of salts, their quantitative ratio, and on presence of calcium sulfates. Besides generally accepted methods of determining carbonate capacity of natural waters, the method of theoretical computation of calcium-carbonate equilibrium can be used. (Josefson-HISGS) W74-03258

DETERMINATION OF FATTY ACID COM-POSITION BY GAS CHROMATOGRAPHY: I. ANALYSIS WITH USE OF THERMAL CON-DUCTIVITY DETECTOR,

Japan Oil Chemist Society, Tokyo. Gas Chromatography Committee. S. Watanabe, S. Hayano, T. Akiya, K. Mimura,

and H. Nakasato.

Journal of the American Oil Chemists' Society, Vol 50, No 9, p 357-359, September 1973. 3 tab, 4

Descriptors: \*Gas chromatography, Statistical methods, Data processing, Methodology. Identifiers: \*Standard methods, Collaborative studies, Accuracy, \*Fatty acids.

Gas chromatographs with thermal detectors were used by a collaborative study team to carry out replicate analyses of fatty acids for the purpose of establishing standard methods. Statistical methods were used to determine: (1) the relationship between operating conditions of the equipment and deviation from real values or scattering of data, (2) whether the difficulty in making peak measurements accounted for scattering of values, (3) the effect of enlarging peak size by adjusting attenuator range or chart speed, and (4) the effect of using response correction factors. From the results of the four collaborative works it was found that deviation of analytical values from exact composition and interlaboratory scattering of data may be considerably decreased by the following means: (1) enlarging the size of narrow peaks (less than 5 mm at a half height) or peaks with low height by adjusting the attenuator range or chart speed; (2) correcting the analytical values by using correction factors determined from analysis of known mixtures having composition similar to that of an unknown sample. (See also W74-03312) (Little-Battelle)

DETERMINATION OF FATTY ACID COM-POSITION BY GAS CHROMATOGRAPHY: II. ANALYSIS WITH USE OF FLAME IONIZA-TION DETECTOR, Japan Oil Chemist Society, Tokyo. Gas Chro-

matography Committee.

S. Watanabe, S. Nakasato, S. Hayano, H. Kuwamura, and T. Nagai.

Journal of the American Oil Chemists' Society, Vol 50, No 9, p 360-363, September 1973. 4 tab, 6

Descriptors: \*Gas chromatography, Statistical methods, Methodology.
Identifiers: \*Fatty acids, \*Collaborative studies,
\*Sample size, Interlaboratory tests, Accuracy.

Gas chromatographs with flame ionization detectors were used in collaborative analyses of known mixtures of four or five fatty acid methyl esters The resulting data were treated statistically to examine the inter - and intralaboratory scatter and the effect of using correction factors. Average values in some cases did not approach actual values even when only data with small deviations ere accepted. In some laboratories a sort of regularity was observed in the deviation of analytical values from real values throughout the analyses of four samples. The application of correction factors to the analytical values obtained by these laboratories resulted in a considerable decrease of interlaboratory scattering and deviation from the real values. When a constant amount of sample was injected, intralaboratory scattering was decreased, whereas interlaboratory scattering was not. Injection of large sample sizes caused deviation. From this collaborative study it was recommended that 0.5-1.0 microliter of 20 percent solution be in-jected. (See also W74-03311) (Little-Battelle) W74-03312 tion of large sample sizes caused deviation. From

GEOCHEMICAL HYDROLOGY OF THE BATON ROUGE AQUIFERS,
Louisiana State Univ., Baton Rouge. School of

Geoscience.

For primary bibliographic entry see Field 04B. W74-03335

TRACE-ELEMENT DISTRIBUTION IN THE CONTINENTAL-SHELF SEDIMENTS OFF THE EAST COAST OF INDIA, Andhra Univ., Waltair (India). Dept. of Geology.

For primary bibliographic entry see Field 02J. W74-03350

OXYGEN AND CARBON ISOTOPE COMPOSI-TIONS OF ALTERED CARBONATES FROM THE WESTERN PACIFIC, CORE 53.0, DEEP SEA DRILLING PROJECT, Illinois Univ., Urbana. Dept. of Geology For primary bibliographic entry see Field 02J.

AN EVALUATION OF WATER-QUALITY DATA OBTAINED AT FOUR STREAMFLOW DAILY-RECORD STATIONS IN IDAHO, Geological Survey, Boise, Idaho. For primary bibliographic entry see Field 05A. W74-03507

SATURATED CALCITE SOLUTIONS FROM 10 TO 40 DEG C: A THEORETICAL STUDY EVALUATING THE SOLUBILITY PRODUCT AND OTHER CONSTANTS.

R. G. Picknett. Transactions of the Cave Research Group of Great Britain, Vol 15, No 2, p 67-80, June 1973. 8 fig, 6 tab, 30 ref, append.

Descriptors: \*Water chemistry, \*Calcite, \*Solu-bility, \*Saturation, Aqueous solutions, Chemical properties.
Identifiers: Solubility product.

Theoretical evaluations of ion concentrations in limestone solution, necessary for the understand-ing of such basic processes as rates of solution and deposition, can only be made if values for all equilibrium constants are known. Published experimental pH data for saturated calcite solutions were used to derive values for the following constants: the solubility product of calcite; the constant for equilibrium between CaHCO3, Ca and HCO3; and the constant for equilibrium between CaCO3, Ca and CO3. The results, covering the temperature range 10 deg to 40 deg C, are com-pared with other published values and are tested by comparing the theoretically predicted properobjections are theoretically predicted properties of saturated calcite solutions with published experimental data. The properties of calcite solutions can be predicted with moderate accuracy for concentrations up to 550 ppm in the temperature range 10-40 deg C. (Knapp-USGS) W74-03525

INVESTIGATION OF THE CHEMICAL COM-POSITION OF ATMOSPHERIC PRECIPITA-TION IN THE VICINITY OF YEVPATORIYA IION IN THE VICINITY OF TEVYATORITA (ISSLEDOVANIYE KHIMICHESKOGO SOSTAVA ATMOSFERNYKH OSADKOV V RAYONE G. YEVPATORII),

. I. Larionova. In: Metody khimicheskogo analiza i sostav prirod-nykh vod: Gidrokhimicheskiye Materially, Vol 53, p 3-9, 1972, 4 tab, 16 ref.

Descriptors: \*Water chemistry, \*Water analysis, \*Chemical analysis, \*Chemistry of precipitation, \*Precipitation (Atmospheric), Inorganic compounds, Salts, Halogens, Ions, Winds, Meteorology, Water sampling, Seasonal.

Identifiers: \*USSR (Yevpatoriya), Mineralization.

Mineralization of atmospheric precipitation collected near Yevpatoriya on the Crimean west coast varies widely, between 45.62 and 680.07 mg/liter. The maximum amount of salts in precipitation occurs in March and December and the minimum amount in May and July. Most precipitation samples are rich in calcium and are the least mineralized. Mineralization is highest in precipitation samples which are rich in calcium sulfate. A relation was established between ion concentration in precipitation and wind direction. The quantity of salts supplied by precipitation to Lake Bol'shoye Moynakskoye near the Yevpatoriya health resort is 96.4 metric tons. Average salt concentration is 161.73 mg/liter. Results of chemical analyses of 24 precipitation samples collected at the Yevpatoriya station in March 1964-February 1965 are tabulated. (Josefson-USGS) W74\_03526

### **Group 2K—Chemical Processes**

CHEMICAL COMPOSITION OF WATER IN AGRAKHANSKIY BAY (O KHIMICHESKOM SOSTAVE VODY AGRAKHANSKOGO ZALIVA).

Gidrokhimicheskii Institut, Novocherkassk

Yu. I. Volovik, and A. A. Zenin.

In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 10-16, 1972. 1 fig, 4 tab, 3 ref.

Descriptors: "Water chemistry, "Water analysis, "Chemical analysis, Inorganic compounds, Water properties, Color, Hydrogen ion concentration, Gases, Organic matter, Seasonal, Water sampling. Identifiers: "Dagestan ASSR, "USSR (Agrakhanskiy Bay), Mineralization.

The northern and southern parts of Agrakhanskiy Bay in Dagestan ASSR differ in hydrologic and hydrochemical regimes. The chemical composition of water in the northern part at Chakannyy village and in the southern part at Novaya Kosa village was investigated to determine its suitability for fish culture. Mineralization of water in the northern part varied between 349 and 635 mg/liter, and mineralization of water in the southern part in summer varied between 500 and 600 mg/liter. The content of biogenic substances in the northern part was sufficiently high during all seasons, while the content of biogenic substances in the southern part in summer dropped to zero. Permanganate oxidizability in water of the northern part varied between 6.2 and 17.9 mg of oxygen/liter, reaching the maximum value in summer. Permanganate oxidizability in water of the southern part was 26.5-30.2 mg of oxygen/liter. The gas composition of water in the northern part during all seasons of the year was favorable to organism activity. The oxcontent varied between 6.50 and 10.87 mg/liter. The gas regime in the southern part was less favorable to living organisms, promoting annual summer eutrophication. Results of chemical analyses of water in the northern part in 1964-65 and in the southern part in 1964 are tabulated. (Josefson-USGS) W74-03527

CHARACTER OF SEASONAL DISTRIBUTION OF MINERALIZATION OF WATER IN THE TSIMLYANSK RESERVOIR (O KHARAKTERE SEZONNOGO RASPREDELENIYA MINERALIZATSII VODY TSIMLYANSKOGO VODOKHRANILISHCHA),

Gidrokhimicheskii Institut, Novocherkassk (USSR).

V. I. Rogozhkin, A. A. Zenin, A. S. Yakusheva, and L. T. Pavelko.

In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 17-20, 1972. 1 fig, 6 ref.

Descriptors: \*Water chemistry, \*Reservoirs, \*Distribution patterns, \*Seasonal, Variability, Fluctuations, Surveys

triotions, Surveys.
Identifiers: \*USSR, \*Tsimlyansk Reservoir,
\*Mineralization.

Seasonal changes in mineralization of water in the Tsimlyansk Reservoir in southeast Soviet Russia were investigated in hydrochemical surveys conducted by the Novocherkassk Hydrochemical Institute in 1967-68. Three clearly expressed patterns were observed in the seasonal variability of mineralization along the longitudinal axis of the reservoir. In spring, mineralization increased from the upper to the lower part of the reservoir (from 270 to 400 mg/liter). In May-June, mineralization decreased from the upper to the middle part (from 470 to 300 mg/liter) and increased in the lower part (to 370-380 mg/liter) and increased in the lower part (to 370-380 mg/liter) and increased in the direction of the dam. Annual hydrologic characteristics affect only the range of fluctuations of mineralization and not the character of its seasonal change in a reservoir. (Josefson-USGS)

MINERALIZATION AND IONIC COMPOSI-TION OF ICE IN SOME WATER BODIES OF THE NORTHERN CAUCASUS (O REZHIME MINERALIZATSII I IONNOGO SOSTAVA L'DA NEKOTORYKH VODOYEMOV SEVERNOGO KAYKAZA),

Gidrokhimicheskii Institut, Novocherkassl (USSR).

I. M. Korenovskaya, and M. N. Tarasov.
In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 21-32, 1972. 6 fig, 4 tab, 11 ref.

Descriptors: \*Water chemistry, \*Ions, Ice, \*Ice cover, \*Ponds, Inorganic compounds, Air temperature, Winter, Water sampling. Identifiers: \*USSR (Northern Caucasus), \*Mineralization.

Hydrochemical characteristics of ice and of water on the underside of ice were investigated for three ponds in the Northern Caucasus in the winters of 1964-65, 1966-67, and 1967-68. Mineralization of ice is closely associated with its growth. By the end of complete ice cover, mineralization of ice in different years had dropped by a factor of 2-6. Mineralization of ice averaged 2%-22% of the mineralization of water under ice. Despite temporal changes in mineralization of ice, its relative chemical composition remained almost the same and was similar to the composition of water under ice. (Josefson-USGS) W74-03529

MICROELEMENT CONTENT AND REGIME IN WATER AND SUSPENDED SOLIDS IN THE VOLGA RIVER BASIN (SODERZHANIYE I REZHIM MIKROELEMENTOV V VODE I VO VZVESHENNYKH VESHCHESTVAKH V BASSEYNE R. VOLGI),

Gidrokhimicheskii Institut, Novocherkassk

G. S. Konovalov, and A. A. Ivanova.

G. S. Konovaiov, and A. A. Ivanova.
In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 60-70, 1972. 7 fig, 27 ref.

Descriptors: \*Water chemistry, \*Trace elements, \*Dissolved solids, \*Suspended solids, \*Metals, Manganese, Nickel, Cobalt, Copper, Zinc, Molybdenum, Lead, Floods, Low flow, Water sampling. Identifiers: \*USSR (Volga River), Vanadium, Tin, Silver.

Concentrations of V, Mn, Ni, Co, Cu, Zn, Mo, Sn, Ag, Pb, and Bi were determined in water and suspended-solids samples collected at 43 points on the Volga River and its major tributaries and reservoirs during spring floods and summer low flows in 1962-63. The Volga River basin is characterized by generally low concentrations of most of these microelements in solution and in suspended solids. Distribution of Ni, Cu, and Zn in solution and of Zn, Mo, Ag, and Pb in suspended solids is relatively uniform throughout the river basin. Increased concentrations of dissolved V and of Cu and Sn in suspended solids are observed in downstream reaches of the Volga. Concentrations of Mn and Mo in suspended solids and of V, Mn, and Ni in solution in Volga River water decrease from excessively wet forested lands, where the pH of surface waters and groundwater is low, to the dry steppes and semideserts, where the pH of surface waters is higher. Concentrations of Mn, Ni, and Zn in solution and of Ag in suspended solids are generally higher during floods than during periods of low flow. (Josefson-USGS) W74-03533

DISTRIBUTION AND CHARACTERISTICS OF ORGANIC MATTER IN RIVER WATERS OF THE TUNDRA ZONE (RASPREDELENIYE I OSOBENNOSTI ORGANICHESKIKH VESHCHESTV RECHNYKH VOD TUNDROVOY ZONY), Gidrokhimicheskii Institut, Novocherkassk

USSR).

M. P. Smirnov.

In: Metody khimicheskogo analiza i sostav prirodnykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 71-85, 1972. 7 fig, 3 tab, 17 ref.

Descriptors: \*Water chemistry, \*Organic matter, \*Rivers, \*Tundra, Physiographic provinces, Hydrogen ion concentration, Color, Oxidation, Floods, Low flow, Water sampling, Seasonal. Identifiers: USSR, Mineralization.

Analysis of organic-matter distribution and com-USSR (covering almost 1.5 million sq km) was based on determinations of permanganate oxidizability in 700 water samples from 42 points in the European part of the country and in 140 water samples from 11 points in the Asiatic part. Total mineralization of water in European rivers is lower than that in Asiatic rivers. Reaction of tundra waters of Asiatic rivers is neutral and that of European rivers is more acidic. Concentrations of colored and readily oxidizable compounds leached from soil and vegetation are high er in organic matter of Asiatic tundra waters than in organic matter of European tundra waters. Ratios of permanganate and bichromate oxidizability noticeably smaller for European tundra waters noticeably smaller for European tundra waters than for Asiatic tundra waters, except during winter low flow when they are almost the same. The average long-term value of these ratios for river waters of the tundra zone is 46%. Average long-term ratios of organic substances to mineral substances in river waters of the tundra zone are 45%. In the Asiatic part these ratios are somewhat smaller than in the European part. During floods these ratios are larger in rivers of Asiatic tundras; during other seasons these ratios are larger in rivers of European tundras. (Josefson-USGS) W74-03534

TITRIMETRIC DETERMINATION OF URANI-UM WITH ELECTROGENERATED VANADIUM

(V), New Brunswick Lab. (AEC), N.J. C. G. Goldbeck, and M. W. Lerner. Analytical Chemistry, Vol 44, No 3, p 594-596, March 1972. 1 tab, 4 ref.

Descriptors: \*Volumetric analysis, Aqueous solutions, Automation, \*Electrodes, Reduction (Chemical), Ions, Iron, Oxidation, \*Electrochemistry

trochemistry.

Identifiers: \*Uranium, Vanadium, Coulometric titration, Gold sheet, \*Electrogeneration, Potentiometric titration, Precision, Ion selective electrodes, Gauze electrodes, Platinum.

The Davies and Gray method of determining uranium involves reduction to uranium (IV) by iron (II) in a phosphoric acid medium, oxidation of excess iron (II) with nitric acid and molybdate catalyst, and titration of the diluted solution with potassium dichromate to a barium diphenylamine potassaum utermate to a bartum uppen yamme sulfonate end point. This method has been modified by titration with electrogenerated vanadium (V). Using a platinum gauze electrode, the mean current efficiency of vanadium (V) obtained at densities of 0.05-1.6 mA/cm squared was 00.07 aborations of 0.05 and various ways. 99.97 plus or minus 0.05 percent. With the expanded gold sheet electrode, essentially the same mean value was obtained in the density range of 0.11-3.3 mA/cm squared. End point potentials in titrating uranium in pure solution and in solutions of mixtures were nearly constant at 570 mV versus SCE. A series of nine determinations with 80-120 mg of uranium using the platinum-gauze generating anode showed a relative standard deviation of 0.062 percent and a relative difference of minus 0.023 plus or minus 0.048 percent (95 percent confidence limits). The same samples were analyzed by the New Brunswick Lab dichromate by the New Brunswick Lab dichromate procedure, and the results agreed very closely with those for coulometric titration. The proposed procedure has little advantage over the manual dichromate titration other than dispensing with the buret and preparation of the standard titrant and

substitution of simpler time read-out for the volume readtout. Also the stability of V (III) requires that the coulometric titrations be completed within seven minutes. (Holoman-Battelle) W74-03564

A MULTIPLE SPECIFIC ION DETECTOR AND ANALOG DATA PROCESSOR FOR A GAS CHROMATOGRAPH QUADRUPOLE MASS SPECTROMETER SYSTEM,

California Univ., Los Angeles. Dept. of Pharmacology.

D. J. Jenden, and R. W. Silverman.

Journal of Chromatographic Science, Vol 11, No 11, p 601-606, November 1973, 6 fig. 2 tab. 21 ref.

Descriptors: \*Mass spectrometry, \*Gas chromatography, \*Computer programs, Analog comuters, Data processing.

puters, Data processing.

Identifiers: Ion detectors, Recorders, GC-Mass

spectrometry.

A system is described which allows a quadrupole mass spectrometer to be used as an 8-channel mulecific ion detector for a gas chromatograph. Eight separate outputs are provided, each of which may be tuned to any mass peak within the range of the mass spectrometer. Scaling and zero bucking controls are provided on each channel. An analog data processor allows up to four sets of linear combinations to be calculated from the outputs, which may thus be made specific for isotopic variants rather than nominal masses. A set of semi-automatic peak integrators allows ion currents for eight masses to be separately integrated over a chromatographic peak, using only a single channel recorder to monitor the peak. A usable mass spectrum may be obtained in this way from 1 ng of a compound when a reference spectrum is available for comparison. (Mortland-Battelle) W74-03580

COMPARISON OF FIELD AND SIGMA-INDU-CTIVE MODELS FOR THE TRANSMISSION OF NONCONJUGATIVE SUBSTITUENT EFFECTS. THE 2,6-SPIRO (3,3) HEPTYL SYSTEM, Georgia Inst. of Tech. Atlanta. School of Chemis-

try. C. L. Liotta, W. F. Fisher, and G. H. Greene. Chemical Communications p 1251-1252, 1969. 1 fig. 2 tab, 6 ref. OWRR B-049-GA (7) 14-31-0001-3269.

Descriptors: \*Aqueous solutions, \*Acids, Chemicals, \*Organic acids, Acid-base equilibrium. Identifiers: Kirkwood-Westheimer \*Ethanol.

The pKa values of a series of 6-substituted spiro (3.3) heptane-2-carboxylic acids have been measured in 50% (by weight) aqueous ethanol and the results analysed in terms of the mechanism of transmission of nonconjugative substituent effects. W74-03737

OF THERMODYNAMICS ACID-BASE EQUILIBRIA. M' AND P' HYDROXYBENZAL-DEHYDE,

Georgia Inst. of Tech. Atlanta. School of Chemis-

try.
C. L. Liotta, K. H. Leavell, and D. F. Smith, Jr. Journal of Physical Chemistry, Vol 71, No 9, p 3091-3092, August 1967. 3 tab, 11 ref. OWRR B-049-GA (6). 14-31-0001-3269.

Descriptors: Thermodynamics, \*Phenols, \*Ionization, Acidity, \*Acid-base equilibrium.

Identifiers: \*Hydroxybenzaldehyde, Solute-solvent interaction.

The p (K sub a)'s of m and p hydroxybenzal-dehyde have been measured from 14-56C in water.

From these data the delta H and delta S of ionization were calculated. The results were analyzed in terms of solute-solvent interaction mechanisms.

CLASS TRANSITION WITH NECATIVE CHANGE IN EXPANSION COEFFICIENT, Purdue Univ., Lafayette, Ind. Dept. of Chemistry. For primary bibliographic entry see Field 01B.

### 2L. Estuaries

W74-03302

UNDERGROUND STORAGE AND RETRIEVAL OF FRESH WATER FROM A BRACKISH-

-WATER AQUIFER,
Geological Survey, Norfolk, Va.
For primary bibliographic entry see Field 04B. W74-03237

BROWN SEAWEED AS AN INDICATOR OF HEAVY METALS IN ESTUARIES IN SOUTH-WEST ENGLAND,

Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab. For primary bibliographic entry see Field 05C.

THE ZOSTERA EPIFAUNAL COMMUNITY IN

THE YORK RIVER, VIRGINIA, Florida Atlantic Univ., Boca Baton. Dept. of Biological Sciences. For primary bibliographic entry see Field 05A.

LARVAE OF THE BURROWING SHRIMP, UPOGEBIA AFFINIS, (CRUSTACEA, DECAPODA, UPOGEBIIDAE) FROM VIRGINIA PLANKTON,

Virginia Inst. of Marine Science, Gloucester Point. P. A. Sandifer.

Chesapeake Science, Vol 14, No 2, p 98-104, June 1973. 4 fig, 13 ref.

Descriptors: \*Larval growth stage, \*Zooplankton, \*Chesapeake Bay, Crustaceans, Invertebrates, Estuarine environment, Marine animals, Larvae, Shrimp, Plankton, Estuaries, Sampling, Specia-

Sminip, Frankton, Estuaries, Sampung, Specia-tion, Virginia. Identifiers: \*Upogebia affinis, \*York River, \*Zoeae, Animal morphology, Burrowing shrimp, Decapods, Clarke-Bumpus Quantitative Plankton sampler.

Four zoeal stages of Upogebia affinis taken in plankton samples from the York River estuary and adjacent lower Chesapeake Bay, Virginia, are described and figured. Upogebia affinis zoeae may be identified readily in plankton samples. Distinguishing characteristics include an unarmed carapace and rostrum in all stages, the shape and pearance of the endopodites of the pereiopods in late stages. (Holoman-Battelle) W74-03303 spination of the telson, and the flattened ap-

STANDING CROP OF SALT MARSHES SUR-ROUNDING CHINCOTEAGUE BAY, MARY-LAND-VIRGINIA,

Maryland Univ., Solomons. Natural Resources Inst.

C. W. Keefe, and W. R. Boynton. Chesapeake Science, Vol 14, No 2, p 117-123, June 1973. 1 fig, 3 tab, 28 ref.

Descriptors: \*Standing crops, \*Salt marshes, Tidal marshes, Organic matter, Chemical analysis, Marsh plants, Plant tissues, Phosphorus, Potassi-um, Vegetation, Carbon, Nitrogen, Calcium, Magnesium, Biomas ginia, Maryland. Biomass, Estuarine environment, VirIdentifiers: \*Chemical composition, \*Marsh grasses, \*Chincoteague Bay, Sample preparation, Species abundance, Spartina alterniflora, Dry ashing, Distichlis spicata, Marine environment.

Chincoteague Bay is surrounded by approximately 95 sq km (23,000 acres) of irregularly flooded salt marsh dominated by short Spartina alterniflora. The maximum standing crop, chemical composition, and live:dead ratio of the marsh grasses were estimated from samples taken at 20 marsh stations in August, 1970. Samples consisting of all the aerial plant parts were taken from a total of 20 sites. Plant parts lying on the ground and no longer attached to the plant were also included in the sample. The samples were oven-dried to constant weight at 100C, and the estimated weight of plant material per sq m at each station was determined. To obtain weights of organic material, the samples were ground, charred, and burned at 550C until the ash weight remained constant. Ash-free dry weight was then determined as the difference between the weight of the ash and the weight of the subsample. The pulverized samples were analyzed for C, N, P, K, Ca, and Mg. Live standing crop ranged from 427 to 558 g dry matter/sq m and 335 to 470 g organic matter/sq m. The total standing crop of live plants consisted of 48 million kg of dry material of which 39 million kg was organic material. Chemical analysis indicated that phosphorus and potassium were rapidly leached from the dead plants while magnesium tended to be retained. Live:dead ratios ranged from 0.9 to 2.3 and were lower than those found in regularly flooded marshes. (Holoman-Battelle) W74-03304

MORTALITY OF MARKET-SIZED OYSTERS (CRASSOSTREA VIRGINICA) IN THE VICINI-TY OF A DREDGING OPERATION,

Maryland Univ., Solomons. Natural Resources For primary bibliographic entry see Field 05C.

W74-03305

MUD SHRIMP (CAULIANASSA) LARVAE (CRUSTACEA, DECAPODA, CALLIANAS-SIDAE) FROM VIRGINIA PLANKTON,

Virginia Inst. of Marine Science, Gloucester Point. P. A. Sandifer.

Chesapeake Science, Vol 14, No 3, p 149-159, September 1973. 7 fig, 14 ref.

Descriptors: \*Zooplankton, \*Chesapeake Bay, \*Larval growth stage, Crustaceans, Invertebrates, Ecological distribution, Estuarine environment, Shrimp, Larvae, Plankton, Speciation, Sampling, Estuaries.

Identifiers: \*Mud shrimp, \*Zoeae, Animal morphology, Sample preservation, Decapods, Callianassa biformis, Callianassa atlantica, Bongo sampler, Clarke-Bumpus sampler.

Larval stages attributed to three species of Callianassa (designated as spp. A, B and C) taken in plankton samples from the lower Chesapeake Bay are described and figured. Evidence concerning tentative identification of spp. A and B is discussed, and it is suggested that these larvae may be ascribed to Callianassa biformis and Callianassa atlantica, respectively. (Holoman-Battelle) W74-03307

INVESTIGATION OF THE PUBLIC AND PRIVATE INTERESTS IN THE CHESAPEAKE BAY AREA.

Maryland Univ., College Park. Dept. of Agricultural and Extension Education.
For primary bibliographic entry see Field 06B.

### Group 2L—Estuaries

TIDAL INLETS FOR PRESERVATION OF

ESTUARIES, Lockwood, Andrews and Newnam, Inc., Houston, Tex. M. G. Lockwood, and H. P. Carother.

Conference reprint available from ASCE, 345 E. 47th St., New York, N.Y. for \$0.50 paper copy. In: ASCE Environmental Engineering Conference, Dallas, Texas, February 6-9, 1967. Conference Preprint 415, 33p. Also in: Journal of the Waterways and Harbors Division, American Society of Civil Engineers, Vol 93, No WW4, p 133-152, Nov. 1967. 12 fig, 2 ref, 1 append.

Descriptors: \*Texas, \*Estuaries, \*Sediment transport, Barrier islands, \*Inlets (Waterways), Pollution, Recreation, \*Engineering structures, Mixing, Environmental control, Fisheries, Fresh water, Salinity, \*Water pollution control. Identifiers: Flushing.

A basic proposition of the Texas Water Plan is to use gulf waters as much as possible to preserve bay and estuary environments, thereby minimizing needs for fresh water. The complex problems in-volved in the design and building of balance tidal inlets to allow free inflow of adequate gulf water are reviewed from the standpoint of coastal engineering and tidal hydraulics. Environmental controls include use of inlets to both increase and decrease salinity, aid circulation and mixing of the waters, and provide sufficient tidal flushing to help the estuary assimilate treated return flows. Concepts of typical inlet design, including the sediment transport aspects, water and salinity balance, and tidal process, are presented. Misuse of imbalanced inlets is demonstrated by extreme values of tractive force. The astonishing magnitude of value of these estuaries for recreation, and sport and commercial fishing clearly establishes the necessity to save these aspects of the bays and estuaries. Reason dictates that scientific use must be made of balanced tidal inlets along this coast. (Sinha-OEIS) W74-03342

NUMERICAL CALCULATION OF WAVE REFRACTION DIGITAL COMPUTER, Texas A and M Univ., College Station. Coastal and Ocean Engineering Div.
For primary bibliographic entry see Field 08B.

W74-03343

EFFECTS OF PARTICLE SIZE AND WAVE STATE ON GRAIN DISPERSION,

Chicago Univ., Ill. Dept. of Geophysical Sciences. S. P. Murray.

Available from NTIS as AD-643 824, for \$6.00 June 1966. 87 p. 20 fig, 5 tab, 53 ref. Nonr-2121 (26), NR 388-074.

Descriptors: \*Massachusetts, \*Waves (Water), \*Sediment transport, Hydrodynamics, Shallow water, Coasts, Beaches, \*Particle size, \*Disper-Identifiers: \*Buzzards Bay (Mass)

The dispersion of three sizes of tagged grains normal to the shoreline by shoaling wind waves was studied in Buzzards Bay, Massachusetts. Experiments were restricted to periods during which wave crests approached parallel to the shoreline. Determination of the frequency of tagged grains in samples taken from the bottom lead to the con-struction of concentration maps. Analysis of the concentration maps yielded a value of an index of net movement for each grain size in each experi-ment. The maximum horizontal velocity under the wave crest near the bottom was computed from measurements of wave geometry and water depth. Within the experimental range of the data it is concluded that under the same wave conditions, finer grain sizes have a greater tendency to move offshore than coarser grains. A change in wave state resulting in an increase in the maximum horizontal velocity near the bottom produces an increase in the tendency for all test grain sizes to move seaward. Theoretical concentrations computed from the equations of turbulent diffusion of contaminant particles in the atmosphere agree qualitatively with the empirical observations of this study and help to explain them. (Sinha-OEIS) W74-03346

RECENT COASTAL SEDIMENTATION: CENTRAL LOUISIANA COAST.

Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

J. M. Coleman.

Louisiana State University Press, Coastal Studies Series No. 17, 1966. 73 p, 27 fig, 8 tab, 62 ref, \$2.50. Nonr 1575 (03).

\*Louisiana. \*Sedimentation. Descriptors: \*Coasts, Sea level, \*Deltas, Marshes, Swamps, Bays, Stratigraphy, Reefs, \*Shallow water, Mud-flats, \*Sediment distribution.

The Recent near-surface sediments of Vermilion. Iberia, and St. Mary Parishes, Louisiana, may be divided into two types: those sediments which were deposited by now abandoned Mississippi River distributaries and those carried along shore and deposited at the delta margin. The oldest recognizable Recent Mississippi River delta, the recognizable Recent Mississippi River delta, the Maringouin or Sale-Cypremort, was actively depositing sediments in this region approximately 4600 years ago. During its development, quantities of fine-grained sediment were swept westward by longshore currents beyond the limits of the delta proper, blanketing the adjacent coast. Resulting mudflats caused coastal progradation, the domi-nant process of the marginal deltaic area. Immediately following the formation of mudflats, en-croachment by salt-tolerant marsh vegetation began, and the process of blanket coastal peat formation was initiated. Later, a change in delta posi-tion caused a decrease in longshore sediment supply, and regional subsidence became dominant. Subsequent shoreline retreat under wave attack resulted in the formation of local beach ridges that were later stranded by another influx of sedi-ments. Several similar cycles of sedimentation, marsh development, and beach-ridge formation are found in the shallow subsurface. These cycles can be correlated with various changes in the Mississippi River delta position. (Sinha-OEIS) W74-03345

PRELIMINARY REPORT ON THE HYDROG-RAPHY OF THE PENSACOLA BAY ESTUARY, FLORIDA.

Florida Dept. of Natural Resources, St. Petersburg. Marine Research Lab. R. M. Gallagher.

Special Scientific Report No 29, November 1971. 36 p. 5 fig. 8 tab. 5 ref.

Descriptors: \*Florida, \*Estuaries, \*Meteorology, Rainfall, Runoff, Salinity, Temperature, Dis-solved oxygen, \*Hydrography, \*Stratification, \*Bays, Data, Hydrogen ion concentration, Monitoring.
Identifiers: Pensacola Estuary (Fla).

Temperature, salinity, dissolved oxygen, and pH were monitored from September through December 1970 in the Pensacola Estuary, Florida. Temperatures ranged from 12.3 to 32.0C, salinities from 0.0 to 34.5 o/oo. These values did not fluctuate beyond those normally expected in respect to meteorological influences. Dissolved oxygen values at the surface were generally saturated but bottom values during September were generally below 58% of saturation in Escambia Bay, probably because of increased slainity stratifica-tion during periods of higher rainfall runoff and ated temperatures. Analyses of pH values (which approached oceanic conditions except near river mouths) were inconclusive. (Sinha-OEIS)

W74-03347

MATHEMATICAL SIMULATION OF TIDAL TIME-AVERAGES OF SALINITY VELOCITY PROFILES IN ESTUARIES,

VELOCITY PROFILES IN ESTUARIES,
Massachusetts Inst. of Tech., Cambridge.
J. S. Fisher, J. D. Ditmars, and A. T. Ippen.
Available from NTIS, Springfield, Va, 22151, as
COM-73-10053, for \$3.00 paper copy, \$1.45
microfiche. Sea Grant Publication Report No
MITSG 72-11, Index No 72-311-Ccb, July 1972.
193 p. 40 fig. 21 tab, 27 ref, 3 append. SG GH-88,
SG 2 35150.

Descriptors: \*Estuaries, \*Mathematical models, \*Saline intrusion, Equations, Shoals, \*River flow, Salinity, Model studies. Identifiers: Velocity profiles, Freshwater discharge.

A mathematical model is developed using analytical techniques to determine the longitudinal and vertical distributions of velocities and salinities, averaged over a tidal period, for mixed but par-tially stratified estuaries. The flow field is assumed laterally homogeneous and the estuary width and depth are assumed to be functions of the longitu-dinal coordinate only. Required inputs to the model include the salt intrusion length, the ocean boundary salinity, the distribution of the depth-averaged salinity and the freshwater discharge. The governing equations included in the model are the vertical and longitudinal equations of motion, continuity, salt conservation and an equation of state. The key assumption is that the longitudinal state. The key assumption is that the longitudinic salinity gradient is independent of depth. This decouples these equations and thus permits an analytical solution to be found. Using data from laboratory flume tests from the U.S. Army Waterways Experiment Station and the Delft Hydraulics Laboratory, and field surveys from the James River Estuary, the model solutions are used to find correlations for the mean vertical transfer coefficients of mass and momentum with gross characteristics of the estuary. These correlations, plus the results from a one-dimensional numerical model, permit this analytical model to be used as a predictor of the velocity and salinity profiles in estuaries and to relate changes in freshwater discharge to possible changes in the location of shoaling zones. (Sinha-OEIS) W74-03348

STRUCTURE AND TEXTURE OF A GRAVELLY BARRIER ISLAND IN THE FITZROY ESTUARY, WESTERN AUSTRALIA, AND THE ROLE OF MANGROVES IN THE SHORE DYNAMICS, Australian National Univ., Canberra. Dept. of

Biogeography and Geomorphology.
J. N. Jennings, and R. J. Coventry.
Marine Geology, Vol 15, No 3, p 145-167, October
1973. 10 fig, 1 tab, 56 ref.

Descriptors: \*Gravels, \*Sand bars, \*Barrier Descriptors: "Graveis, "Sand barrs, "Barrier islands, "Sedimentary structures, Stratification, Stratigraphy, Beaches, "Australia, Mangrove swamps, Erosion, Beach erosion, Sediment transport, Sedimentation, Estuaries.

In the stratification of a coarse-textured barrier island on Point Torment peninsula, King Sound, Australia, foreslope beds due to swash-backwash on the beach face are less important than the main units, which are steeply dipping backslope beds and topslope beds of gently, chiefly landward inclination. Their bimodal sediments are poorly sorted for wave-build features. A very coarse mode usually at -1.5 to -2 phi belongs to a population of well-rounded but platy, impure limestone, of local source, whereas the fine mode, almost invariably 1.00 to 1.25 phi, represents a population of quartz sand fed from low to subtidal estuarine shoals. The two populations derive from the sur-face creep and saltation components of traction carpets. Swash of intermediate energy waves forms the topslope beds through percolation. Washover by waves generated by hurricanes erodes the top of the feature and deposits the backslope beds on the rear face in standing water. In both, unidirectional currents produce sediments with resemblances to fluvial traction deposits. The seaward mangrove swamps neither protect the embankments behind nor suffer seriously from the waves. (Knapp-USGS) W74-03351

ARTIFICIAL RECHARGE OF COASTAL-PLAIN AQUIFER IN ISRAEL, Tahal Consulting Engineers Ltd., Tel Aviv

Tahal Consulting Engineers Ltd., Tel Aviv (Israel). Div. of Hydrology. For primary bibliographic entry see Field 04B. W74-03356

CHARACTER AND STABILITY OF A NATU-RAL TIDAL INLET,

Army Coastal Engineering Research Center, Washington, D.C.

Washington, D.C.
C. Mason, and R. M. Sorensen.
Reprint No 10-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 42, p 781-800, 1972. 13 fig, 2 tab, 12 ref.

Descriptors: \*Barrier islands, \*Beaches, \*Inlets (Waterways), Coastal engineering, Beach erosion, Storms, Surges, Tidal effects, Littoral drift, Sedimentation, Waves (Water), Currents (Water), \*Texas. Identifiers: \*Matagorda Bay (Tex).

Brown Cedar Cut, a natural unstable barrier beach inlet connecting East Matagorda Bay, Texas, with the Gulf of Mexico, was studied to determine the physical and hydraulic properties of the inlet, and to investigate the inlet's historical stability, as well as its short-term response to a number of physical processes. Hurricanes and continuing erosion of adjacent beaches enhance the long-term stability of the inlet. During winter months, the rapid passage of strong frontal systems and associated winds, as well as substantial amounts of rainfall, are primarily responsible for the day-to-day viability of the channel boundaries. In the absence of such forces, the predominance of littoral drift over the limited flushing ability of tidal currents leads to degradation of the inlet channel and westward migration of the entire inlet system. (Knapp-USGS)

CASE HISTORY OF MISSION BAY INLET, SAN DIEGO, CALIFORNIA, Moffat and Nichols, Long Beach, Calif. For primary bibliographic entry see Field 08B. W74.01364

THE DRAFT UNITED NATIONS CONVENTION ON THE INTERNATIONAL SEABED AREA - AMERICAN BAR ASSOCIATION POSITION, American Bar Association, Washington, D.C. Natural Resources Law Section.

For primary bibliographic entry see Field 06E.

WMA0377

CALIFORNIA COASTAL ZONE CONSERVA-TION ACT, INTERIM PERMIT CONTROL, GENERAL,

University of Southern California, Los Angeles. For primary bibliographic entry see Field 06F.

THE NATION'S ESTUARIES: SAN FRANCISCO BAY AND DELTA, CALIFORNIA. For primary bibliographic entry see Field 05G. W74-03420 BEACH CHANGES, ON THE CENTRAL TEXAS COAST ASSOCIATED WITH HURRICANE FERN, SEPTEMBER, 1971, Western Michigan Univ., Kalamazoo. Dept. of

Geology.
For primary bibliographic entry see Field 02J.
W74-03433

TIDAL RESONANCE IN THE BAY OF FUNDY AND GULF OF MAINE, Dalhousie Univ., Halifax (Nova Scotia). Inst. of

Dalhousie Univ., Halifax (Nova Scotia). Inst. o Oceanography. C. Garrett.

Nature, Vol 238, No 5365, p 441-443, August 25, 1972. 2 fig, 2 tab, 18 ref.

Descriptors: \*Bays, \*Estuaries, Electrical powerplants, \*Tidal effects, \*Resonance. Identifiers: \*Bay of Fundy, \*Gulf of Maine, Tidal amplitude.

Tidal ratios outside and inside the Bay of Fundy/Gulf of Maine system fall into two distinct groups. The period of the free mode oscillation in the bay is 13.3 h, and this is forced by the lunar M sub 2 tide of the North Atlantic to produce the unusually high tides recorded in the area. The tides in the Bay of Fundy are probably the highest in the world, with a range occasionally greater than 50 foot at places in Minas Basin at the head of the bay. Information is presented on tidal ratios, response function, resonant frequency, and frictional damping for a mixture of tides. Construction of barriers in the upper part of the Bay of Fundy for the generation of electrical power would change the tidal amplitude at any point in the Bay. (Sinha - OEIS)

THE OLD COASTLINE OF THE WASH,
Hydraulics Research Station, Wallingford (En-

gland). F.J. T. Kestner. New Scientist, Vol 15, No 303, p 516-519, September 6, 1962. 7 fig.

Descriptors: \*Estuaries, \*Erosion, \*Sedimentation, Tidal effects, Slope, \*Mud flats, \*Tidal marshes.

Identifiers: Tidal range, \*Wash (England), England East Coast, Tidal flats, Great Britain.

The Hydraulics Research Station of the Dept. of Scientific and Industrial Research has been carrying out field studies in The Wash (east coast of England) as part of a wider program of research dealing with the transport of sand and silts and the processes of accretion and erosion in estuaries. The Wash is a typical example of the large scale changes which can occur when man interferes with the natural balancing mechanism. A theory is presented, explaining the way in which estuaries tend to maintain themselves in balance by a complicated interaction of various accretional and erosional processes. In all estuaries there is a continual movement of sand and silt to and fro on each tide, the sand moving on the bed and the finer material travelling quite long distances in suspension and settling out at slack water. Every estuary tends to build up a pattern of banks and channels such that these movements upstream and downstream are in balance. Sometimes this may be a stable configuration, so that no changes at all appear to occur; more commonly, it is a cyclic pattern of shifting sandbanks and mud flats which build up and are periodically cut down again. This pattern repeats itself over a period of months or years, and there is no long-term progressive deterioration in the estuary. The particular pattern in any estuary is limited by various factors, the most important of which are the tidal range and bed slope and any permanent natural or artificial boundaries to the flow of the tide. Where a highly mobile suspended load is present the balance in an estuary is much more delicately poised and more easily disturbed. (Sinha - OEIS)

SIZE DISTRIBUTIONS OF THE SUSPENDED PARTICLES OF THE CHESAPEAKE BAY TURBIDITY MAXIMUM,
Johns Hopkins Univ., Baltimore, Md. Chesapeake

Bay Inst. J. R. Schubel

Netherlands Journal of Sea Research, Vol 4, No 3, p 283-309, 1969. 11 fig. 3 tab, 9 ref.

Descriptors: \*Chesapeake Bay, \*Estuaries, \*Turbidity, \*Sediments, Suspended load, Particle size, \*Tidal effects.

Identifiers: Suspended sediments, Scour and fill.

An intensive investigation of the Chesapeake Bay's turbidity maximum has shown that its suspended particle population is determined by the physical processes, local resuspension and the net non-tidal estuarine circulation, which combine to produce the turbid zone: and that the suspended particles have a narrow size distribution both in terms of equivalent projected diameters and Stokes' diameters or settling velocity ('size') distributions by a sedimentation technique. The suspended particle population of the Chesapeake Bay's turbid zone is composed of two sub-populations. One sub-population is comprised of particles with settling velocities of the same order as the vertical mixing velocities. These particles form a 'natural background' of suspended sediment found throughout the water column and whose concentration and particle size distribution are very uniform over periods of weeks or months. The second sub-population consists of particles which are alternately suspended and deposited. The presence of this sub-population is made manifest by semi-tidal fluctuations of the concentration of suspended sediment in the lower layer at stations deeper than about 4 m and throughout the water column at shallower stations. The fluctuations produced by tidal 'scour and fill' are accompanied by marked changes in the volume-size distribution and increase in magnitude near the bot-tom - the sediment source. (Sinha - OEIS)

DYNAMIC CHARACTERISTICS OF WEST FLORIDA GULF COAST BEACHES, University of Southern California, Los Angeles.

Dept. of Geology. For primary bibliographic entry see Field 02J. W74-03437

WATER MOVEMENTS IN SHALLOW COASTAL BAYS AND ESTUARIES, Miami Univ., Fla. Sea Grant Institutional Pro-

T. N. Lee, and C. Rooth.

Coastal Zone Management Bulletin Series No. 3, January 1973. 19 p, 6 fig, 2 ref. SG 2-35147, AEC (AT (40-1)-3801-4).

Descriptors: \*Estuaries, Coasts, \*Bays, Ecology, Hydrology, Water pollution, Runoff, \*Tides, \*Mixing, \*Shallow water, \*Florida. Identifiers: Exchange processes, Nearshore.

A modular approach for understanding estuarine water movements is presented. Estuarine exchange processes are typically controlled by the forces of tides, winds, river run-off, evaporation and precipitation. These forces display large variations in time and space between different estuaries and within any given estuary due to the geographic locations and complexities of shapes. The modular approach separates an estuary into characteristic regions. The building blocks consist of regions of direct exchange between an estuary and the coastal waters, interior basins, the regions of exchange between basins, and the region of river influence. The emphasis in this paper is on mixing processes within the interior of estuaries. (Sinha-OEIS)

### **Group 2L—Estuaries**

THE COASTAL SHOALS OF WESTERN CUBA AND THEIR DEPOSITS, Akademiya Nauk SSSR, Moscow. Institut Oke-

V. P. Zenkovich.

Oceanology, Vol 9, No 2, p 207-221, December 1969. 8 fig, 19 ref.

Descriptors: Coasts, \*Shoals, \*Algae, Calcium carbonate, \*Mangrove swamps, Peat, Mud, Coral, \*Shallow water, \*Sand bars, Sands, Topography. Identifiers: \*Cuba, Halimeda, Ooliths, Bottom topography.

Coastal surveys were made during the 1965 Soviet-Cuban expedition. Forty-seven cores were taken with a vibrating piston tube from the shoals of Cuba. In many places (to a depth of 13 m) the tube penetrated superficial deposits indicative of recent subsidence of the region. Dominant in recent shoal sand are calcareous flakes of the alga Halimeda and chemically precipitated calcium carbonate. The latter also forms viscous mud. Ooliths are now accumulating along the south edge of Los Canarreos Archipelago. The deposits at the edge of mangrove forests show peat seams as much as 1 m thick. Strong, surging, tidal and seasonal currents develop on all shoals. They are creating a ridged bottom in both sand and mud deposits. In Guacanayabo Bay there are some very complex, lithified ridges overgrown by corals. It is assumed that they are preserved mud ridges. (Sinha-OEIS) W74-03443

THE SPECTRAL STRUCTURE OF WAVES IN THE NEARSHORE ZONE.

G. G. Kuz'minskaya

Oceanology, Vol 5, No 3, p 14-17, 1965. 2 fig, 1 tab, 5 ref.

Descriptors: \*Waves (Water), \*Shallow water, Harbors.

Identifiers: \*Nearshore, \*Wave spectrum.

Spectral functions in the nearshore zone differ considerably from those in deep water. Owing to refraction the difference between the directions of propagation of individual components is reduced. In order to study the deformation of the wave spectrum in the nearshore zone the deepwater spectrum was divided into a number of components, for which wave lengths and propagation directions were different. The information obtained made it possible to determine the changes undergone by the components of the wave spectrum in the nearshore zone. In this connection it is of interest to compare the deformation of long and short waves of the spectrum in shallow water. In practice the period spectrum may be disregarded when determining wave height in shallow water, and it is sufficient to consider the function of the angular distribution of energy. This will not suffice to yield the wave periods, for which the frequency spectrum must also be known. When calculation of wave height in the nearshore zone is reduced to examination of the deformation of components that differ only in direction, the volume of calculation is significantly reduced without loss of accuracy. Further investigations will make it possible to determine how many components are needed for a given area. It is essential to reduce the volume of calculations, since it is still not known precisely how many components need to be considered: theoretically the number could be infinite. It may be possible to employ only three components in a calculation. (Sinha-OEIS) W74-03448

FALLING WATER LEVEL RIPPLE MARKS, Florida State Univ., Tallahassee. Dept. of Geolo-

Transactions Gulf Coast Association of Geological Societies, Vol 12, p 295-301, 1962. 4 fig, 10 ref.

Descriptors: \*Shallow water, \*Ripple marks, \*Waves (Water), \*Currents (Water). Identifiers: \*Tidal flats, \*Wave action, Near

Ripple marks produced in shallow water, especially when the water level is falling, are more varied, more complex, more easily interpreted, and more valuable in paleogeographic studies than ripple marks developed under other conditions. Shallow-water and falling water-level ripple marks are conveniently studied on sand-floored tidal flats as well as in wave tanks. Tidal flats have the advantage that a variety of wave systems, moving from different directions, can be studied, both singly and in combination. Flat-topped ripple marks, in many different patterns, are formed when the water level drops to, or below, the ripple mark crests. When the rate of water level fall varies systematically, terraced flat-topped ripple marks are produced. Two parallel ripple mark systems, having smaller ridges centered in the troughs between larger ridges, develop as a result of the adjustment of wave orbit diameters during the fall. Helical cell ridges ('rib-and furrow'), windrow ridges, and other long down-current ridges are produced primarily by direct current flow, or by a vector combination of waves and currents, in shallow water. Composite ripple marks arise when the motions of two in-phase wave systems are added vectorially. Out-of-phase combination yields a wavy map pattern. Additional ripple mark types found on the tidal flat or in very shallow water have sharply-pointed troughs and gently rounded crests, or are flat-bottomed despite an abundance of sand. These types may be caused by a combination of wave action and mass flow of shallow water. (Sinha-OEIS) W74-03449

THE RESPONSE OF NARROW-MOUTHED HARBORS IN A STRAIGHT COASTLINE TO PERIODIC INCIDENT WAVES,

Harvard Univ., Cambridge, Mass. Dept. of Mechanical Engineering. G. F. Carrier, R. P. Shaw, and M. Miyata. Transactions of the ASME, Journal of Applied Mechanics p 335-344, June 1971. 12 fig, 6 ref.

Descriptors: \*Harbors, \*Waves (Water), \*Shallow water, \*Coasts, Tsunamis, Resonance. Identifiers: \*Incident waves.

The response to low-frequency periodic plane incident waves of a harbor connected by a narrow channel to the open sea is studied using linearized, constant depth, shallow water wave theory. Particular attention is paid to those frequencies close to the natural frequencies of the harbor basin and to those critical incident frequencies at which a maximum response is found. The theory developed is applicable as long as the width of the channel, and therefore, the harbor entrance is small compared to the incident wave length and to the characteristic dimensions of the harbor basin. Significant amplifications are found at certain incident wavelengths which do not necessarily correspond to the natural frequencies of the harbor basin and a peculiar effect of the length of the en-trance channel on the magnitude of the amplification; values of these critical incident wavelengths are noted. (Sinha-OEIS) W74-03450

THE GENERATION OF EDGE WAVES BY CYLINDRICAL WAVES IMPINGING FROM THE OUTER SEA,

Tohoku Univ., Sendai (Japan). Geophysical Inst. For primary bibliographic entry see Field 02E. W74-03451

THE COASTAL ENVIRONMENT OF NEW EN-GLAND,

Geological Survey, Woods Hole, Mass. R. H. Meade.

Woods Hole Oceanographic Institution Contribution No 2496, 1971. 47 p, 16 fig, 96 ref.

Descriptors: \*Coasts, \*Estuaries, Surface waters, \*Water circulation, Salinity, \*Se Minerals, Bibliographies, \*New England. Identifiers: Glacial ice, Moraine. \*Sediments,

This view of the New England coastal environment focuses on three subjects: the shape of the coastline, the coastal waters, and the coastal sediments. It covers the nonliving aspects of the environment to set the scene within which and with which man and other organisms interact. A guide to sources of further information is included. (Sinha-OEIS) W74-03453

WATER WAVES FROM UNDERWATER EX-PLOSIONS IN SHALLOW WATER, PART I: A MATHEMATICAL MODEL FOR WAVES IN CONSTANT DEPTH AND IN SHOALING WATER,

Naval Civil Engineering Lab., Port Hueneme, Calif.

Available from NTIS as AD-684 473, for \$6.00 paper copy, \$1.45 microfiche. Report No NCEL-TN-824, April 1966. 38 p, 13 fig, 6 ref.

\*Explosions, \*Shallow Descriptors: Beaches, \*Seiches, Gravity waves, Coastal structures, \*Mathematical models, \*Waves (Water), \*Energy transfer.

Identifiers: Wave propagation, Underwater explo-

A technique is provided for the theoretical prediction of the characteristics of the surface gravity water waves generated by an explosion in nearshore shallow water as the waves propagate over a flat bottom and up a sloping beach. It provides the excitation information required to predict the loading--pressures and forces--by such waves on mg-pressures and torces-by such waves on waterfront structures located on the beach. The explosion is simulated by a time-dependent initial disturbance uniformly distributed from the free surface to the bottom. The resulting water motion is assumed to be symmetric about an axis through the center of disturbance. First, the problem of wave propagation is treated by the application and potential theory with appropriate linearized boundary conditions. A closed-form asymptotic solution of surface variations is developed for an exponentially decaying initial disturbance. Next, the problem of wave amplification in shoaling water is considered under the assumption that the energy transfer is constant across any cylindrical surface. Results are compared with measurements made in the wave basin of the U. S. Naval Civil Engineering Laboratory. (Sinha-OEIS) W74-03454

THE EFFECT OF CURRENTS ON THE MASS TRANSPORT OF PROGRESSIVE WATER

National Engineering Science Co., McLean, Va. J. I. Collins

Journal of Geophysical Research, Vol 69, No 6, p 1051-1056, March 15, 1964. 9 fig, 5 ref. ONR Nour

Descriptors: \*Sediment transport, \*Currents (Water), Gravity waves, \*Waves (Water), Dye dispersion.
Identifiers: \*Mass transport, \*Progressive gravity

waves, Near shore, Particle velocity.

The pickup velocity of water offshore of the breaking zone is dominated by the particle orbital velocities of the waves near the bed, whereas the rate of transportation of fine material is dominated by mass-transport effects. The effects of even very small currents on the mass transport of waves could be very large. Results are given of some ex-perimental work on waves with very small superimposed collinear currents. The mass-transport velocities and currents cannot be added algebraically. A theory is developed which is based on the algebraic addition of the particle velocities in the boundary layer at the bed, assuming laminar motion. The agreement between theory and experiment is found to be quite good for small wave heights; it is better for larger wave heights with shorter wave periods than with longer wave periods. (Sinha-OEIS)
W74-03455

MIXING AND CIRCULATION IN GAUTAMI-GODAVARI ESTUARY.

Andhra Univ., Waltair (India). Dept. of Zoology. P. N. Ganapati, and D. V. Rama Sarma. Current Science, Vol 34, No 22, p 631-632, November 20, 1965. 1 fig, 13 ref.

Descriptors: \*Estuaries, \*Circulation, \*Mixing, Salinity, Fresh water, Halocline, \*Tidal effects, Seasonal.

Identifiers: \*India (Godavari Estuary), Cellular circulation, Flushing,

The distribution of salinity in relation to the depth and distance has been studied during the years 1958-62 in the Gautami branch of the Godavari estuary, the second largest in the country. The absence of vertical differences in salinity in the lower estuary during the hot weather season sug-gests operation of a 'cellular type' of circulation as observed by Rochford in the typical tidal eastern Australian systems. The vertical homogeneity in the dissolved oxygen and nutrient concentrations also lend support to the possible occurrence of a 'cullular type' of circulation. Under the influence of the tides these bodies of water move back and forth, each about a mean position. During the early phase of the annual flood period a rapid seaward displacement of these 'cells' of water occurs.
When the river runs into high spates the pattern of cellular circulation becomes disrupted and the estuary becomes filled with freshwater at all levels. (Sinha-OEIS)

PHYSIOLOGICAL ASPECTS OF ANIMAL LIFE IN ESTUARIES WITH SPECIAL REFERENCE TO SALINITY.

Biologische Anstalt Helgoland, (West Germany).

O. Kinne.

Netherlands Journal of Sea Research, Vol 3, No 2, p 222-224, August 1966. 9 fig, 2 tab, 88 ref.

Descriptors: \*Estuaries, \*Salinity, Aquatic plants, Aquatic animals, \*Physiological ecology, \*Ecology, \*Estuarine environment, Stress.

Ecologically, most estuaries represent zones of reduced competition and thus may serve as refuges for organisms which have a great potential for compensating ill effects of physico-chemical properties of their environment, but at the same time have a small potential for competition. Four groups of compensatory devices available to counteract detrimental salinity effects are briefly discussed, namely, escape, reduction of contact, regulation and adaptation. These four groups may not always be distinguishable to the last detail and may occur more or less simultaneously in one and the same individual. For fast compensations the various regulatory devices are most important. They are usually well developed in estuarine animals. Permanent environmental variation is not only the most pronounced characteristic of an estuary: it also represents one of its most ancient and conservative features. By carefully analyzing the means and mechanisms whereby oceanic organisms have succeeded in mastering the estuarine environment, future studies may bring about a better understanding of the forces at work in the process of emigration from the sea. (Sinha-OEIS) W74-03461 WATER LAW OF SOUTHEASTERN ESTUA-RIES.

For primary bibliographic entry see Field 06E. W74-03463

CHEMICAL COMPOSITION OF WATER IN AGRAKHANSKIY BAY (O KHIMICHESKOM SOSTAVE VODY AGRAKHANSKOGO ZALIVA),

Gidrokhimicheskii Institut. Novocherkassk (USSR).

For primary bibliographic entry see Field 02K. W74-03527

POSSIBLE CHANGES IN SALINITY OF WATER IN THE DNIEPER-BUG LAGOON IN CONNECTION WITH FUTURE DIMINUTION OF STREAMFLOW (VOZMOZHNYYE IZ-MENENIYA SOLENOSTI VODY DNEPROV-SKO-BUGSKOGO LIMANA V SVYAZI S PRED-SKO-BUGSKUGG SOKRASHUSTOYASHCHIM SOKRASHUSTOYASHCHIM SOKRASHUSTOYASHUM VERSK, Kiev. Instytut

L. A. Zhuravleva, A. I. Simonov, and I. P.

In: Metody khimicheskogo analiza i sostav prirod-nykh vod: Gidrokhimicheskiye Materialy, Vol 53, p 33-38, 1972. 2 fig, 3 tab, 1 ref.

Descriptors: \*Lagoons, \*Salinity, \*Saline water intrusion, \*Saline water barriers, \*Flow control, Reservoir releases, Dams, Dam construction, Hydroelectric plants, Estuaries, Water balance, Salt balance, Seasonal, Equations. Identifiers: \*USSR (Dnieper River), Bug River.

Four possible variants of change in the hydrochemical regime of the Dnieper-Bug estuarine region at different degrees of diminished streamflow and isolation of the lagoon from the sea were examined for selection of an optimal waterworks system for providing local branches of the national economy with freshwater. Regulation of flow of the Dnieper and Southern Bug will lead to salinization of the entire estuarine region of these rivers. Complete regulation of flow will result in gradual transformation of the Dnieper-Bug lagoon into a bay of the Black Sea. Absence dam at Ochakov to protect the lagoon from effects of the Black Sea, and regulation of releases of the Kakhovka Hydroelectric Plant at a rate of 12.6 cu km/yr will merely prolong salinization of the lagoon by 7-8 years. Construction of a dam at Ochakov without reservoir releases will not solve the problem of lagoon salinization. Salinity of water in the reservoir will rise steadily as a result of seawater intrusion, wastewater contamination, and local salinization. Construction of the Ochakov works and regulation of discharges of the Kakhovka Hydroelectric Plant at a rate of 6-8 cu km/yr will protect the region from salinization and ensure an average slainity of water in the reservoir at 1.0%-1.5%. (Josefson-USGS) W74-03530

NITRATE AND NITRITE IN THE SURFACE WATERS OF MARSHES, Delaw TWO DELAWARE SALT

Delaware Univ., Newark. Dept. of Biological Sciences.

For primary bibliographic entry see Field 05B. W74-03538

DISTRIBUTION OF FORAMINIFERA NEAR POLLUTION SOURCES IN CHALEUR BAY, Bedford Inst., Dartmouth (Nova Scotia). For primary bibliographic entry see Field 05B.

METHYLMERCURY IN ESTUARINE SEDI-MENTS, Florida State Univ., Tallahassee. Dept. of

Oceanography.

For primary bibliographic entry see Field 05B. W74-03602

TOPOGRAPHIC CHANGES IN THE SURF ZONE PROFILE,

Louisiana State Univ., Baton Rouge. Coastal Stu-

For primary bibliographic entry see Field 02J. W74-03609

THE ROLE OF SHELL MATERIAL IN THE NATURAL SAND REPLENISHMENT CYCLE OF THE BEACH AND NEARSHORE AREA BETWEEN LAKE WORTH INLET AND THE MIAMI SHIP CHANNEL, Miami Univ., Fla. Marine Lab.

G. A. Rusnak, K. W. Stockman, and H. A.

Hofmann

Available from NTIS as AD-715 986, for \$3.00 paper copy, \$1.45 microfiche. Final Report No. ML-66857 prepared for Army Coastal Engineering Research Center, October 1966. 61 p. 12 fig, 8 tab, 36 ref, 4 append. DA-49-055-CIV-ENG-63-12.

Descriptors: \*Florida, Coasts, \*Beach erosion, \*Shallow water, \*Sediment transport, Mineralogy, \*Inlets (Waterways), \*Tidal effects, Bays, Sounds, Weathering, Deltas. Identifiers: \*Sand rep

Identifiers: \*Sand replenishment, Nearshore, Beach replenishment.

Study of beach-face and foredune sand samples, collected at intervals of approximately 8 nautical miles over a total distance of 277 nautical miles of beach, was made in an effort to evaluate the sand replenishment cycle. The methods used included grain-size determinations, mineralogic examination of shells and other constituents by x-ray diffraction and optical techniques, standard paleontologic examination of shell assemblages, and assays of contained radiocarbon activity. It may be concluded that relatively little shell is being contributed to the northern beaches of Florida either by erosion of 'older' deposits or contributions from contemporaneous sources. Beaches of South Florida in the vicinity of Lake Worth to Miami receive relatively little quartz sands from northern flood plains and apparently derive equal amounts of shell from old deposits and from contemporaneous sources. Loss of sand from the beaches of South Florida near Lake Worth to Miami may be attributed in part to inlet capture of replenishment sand by tidal currents, but discounting the esticapture by inlets still leaves substantial losses of beach sand to other processes. The evidence for loss to inlets is found in the development of tidal deltas within bays and sounds and in the silting-up of these bays. Apparently, the unac-counted for sand loss is attributable to the spilling of sand off the narrow shelf and loss to deep water. (Sinha-OEIS) W74-03610

THE SALINITY REGIME AND EXCHANGE CHARACTERISTICS OF A SHALLOW COASTAL BAY SYSTEM, Texas A and M Univ., College Station. Dept. of

Oceanography and Meteorology. T. Sakou.

Available from NTIS as PB-168 970, for \$6.00 paper copy, \$1.45 microfiche. Technical Report Reference 63-21T, August 1963. 170 p, 83 fig. 20 tab, 29 ref. 299. NSF-G19780.

Descriptors: \*Texas, Coasts, \*Bays, Shallow water, \*Salinity, \*Forecasting, \*Estuaries, \*Mathematical models, Gulf Coastal Plain, Missis-

A shallow coastal bay system, consisting of several bay units each of which is characterized by quasi-homogeneous salinity and by relatively restricted interconnecting tidal passes, has been investigated with respect to its salinity regime and exchange characteristics. Particular emphasis is on

### Group 2L—Estuaries

the temporal features of the salinity and their predictability from known controlling factors. Data from prototype and hydraulic model observations for the Lake Pontchartrain-Lake Borgne system were used for the analysis. The salinity prediction model is formulated on the basis of the equations of continuity and of salt conservation. The prediction equations for the model were tested by reconstructing the salinity regime for two separate years as an initial value problem using only the inflow data and the control salinity of the outer bay as in-put. The stability and inherent errors of the forecasting relations is discussed. Spectral analysis applied to 12 years of prototype data (salinity and inflow) demonstrates the effectiveness of correlation functions, power spectra and cross-spectra of the variables involved in the description and interpretation of the salinity regime with respect to the frequency response characteristics of the bay system. The cross-spectra are examined in relation to the possibility of applying optimum linear prediction. It was found that better optimum prediction could be made by transforming the input and/or output variables. It is demonstrated that the prediction of the major features of the salinity regime can be made and the merits of the various approaches are discussed. (Sinha-OEIS) W74-03611

PILOT MODEL STUDY FOR THE DESIGN OF HILO HARBOR TSUNAMI MODEL. HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 08B. W74-03613

A MODEL STUDY OF THE ENTRANCE CHAN-

A MODEL STOP OF THE ENTRAICE CHAN-NEL DEPOE BAY, OREGON, Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 08B. W74.03614

LONG WAVE STUDY OF MONTEREY BAY, Naval Postgraduate School, Monterey, Calif. T. J. Lynch.

Available from NTIS as AD-712 794, for \$3.00 paper copy, \$1.45 microfiche. M Sc thesis, September 1970. 89 p, 29 fig, 9 tab, 7 ref, 3 append.

Descriptors: \*Bays, \*Seiches, \*Waves (Water), \*Coasts, \*California, Submarine canyons. Identifiers: Monterey Bay (CA), Oscillations, \*Long waves.

Monterey Bay, on the west coast of the United States, is unique in that it is a large, symmetric, semi-elliptical bay divided north and south by the deep Monterey Canyon. The effect of the canyon on seiching within the bay and on long wave oscillations within the bay was studied by analyzing synchronized wave records at each end of the bay. Power spectra and cross spectra calculated for five periods selected from six months continuous data indicate the Monterey Canyon has a profound effect on the bay's oscillating characteristics. The canyon appears to act as an impedence barrier dividing the bay into two independent oscillating basins each having recurring long-period waves which persist during significant long-wave activity. Extensive reference is made to the work of Wilson, Hendrickson and Kilmer (1965) in their feasibility study for a surge-action model of Monterey Harbor, California. (Sinha-OEIS)

SURFACE CHARACTERISTICS OF WINDROWS.

Naval Postgraduate School, Monterey, Calif. R. W. Ortengren, Jr.

R. W. Ortengren, Jr.
Available from NTIS as AD-683 803, for \$6.00 paper copy, \$1.45 microfiche. M Sc thesis, December 1968. 53 p, 16 fig, 21 ref, 2 append.

Descriptors: \*California, \*Winds, Surface water, \*Aerial photography, Coasts, \*Bays. Identifiers: Monterey Bay (CA), \*Wind slicks, \*Windrows.

Aerial photographs were taken of windrow accumulations in Monterey Bay on 1, 8, 15 and 22 October 1968. A Fairchild T-11 aerial mapping camera was used, with photographs taken approximately every two minutes over 40 to 60 minute periods. Windrows were marked with accumulations of computer cards, wind speed measured by cup anemometer, and wind direction taken with the aid of a MK.6 Smoke Float. Sea surface temperature, depth of the thermocline, and surface air temperature measurements were taken concurrently. An attempt was made to correlate windrow spacing and wind speed, to find mean deflection of windrows relative to the wind, to determine any relationship between row spacing and depth of the thermocline, and to find the response time of windrow orientation to a wind shift. Windrow spacing was found to depend on other factors than wind speed. Deflection angles varied between 20 degrees left and 20 degrees right, with 0 degrees being the most common angle. No correlation was found between depth of the thermocline and row spacing. Response time fell between two and four minutes. (Sinha-OEIS) W74-03618

ONTOGENY OF A SALT MARSH ESTUARY, Woods Hole Oceanographic Institution, Mass. A. C. Redfield.

Science, Vol 147, No 3653, p 50-55, January 1, 1965. 13 ref. NSF GP2042.

Descriptors: New England, \*Estuaries, \*Salt marshes, \*Sand spits, \*Sedimentation, \*Coastal marshes, Tidal marshes, \*Massachusetts. Identifiers: Barnstable (MA), Tidal creeks.

The development of a typical New England salt march, and the growth of the sand spit which shelters it, during the past 4000 years has been reconstructed from soundings and borings of the peat. The results have been interpreted with the aid of observations on the structure of the marsh and estimates of the rate of its vertical accretion based on carbon-14 determinations. The reconstructions provide a picture of the ontogeny of the Barnstable marsh which is orderly and plausible. They indicate that the sand spit has grown eastward during a period of about 4000 years. The marsh, which consisted at first of isolated pockets in protected indentations of the upland, became continuous and began to spread into the enclosure from along the upland margin as sediment accumulated in its shallower parts and protection from the sea became more complete. The development of marsh along the margin of the sand spit proceeded more slowly, perhaps because the basin deepened with distance from the upland and more time was required for sedimentation ot reduce its depth. The broad sounds between the advancing tongues of marshland became the site of the future creeks, and the meandering channels in the sand which formed their bottom defined the final pattern which these creeks assumed. High marsh has now extended to the margin of these channels and at present the creeks are in quasi-equilibrium with the hydraulic forces which arise from the quantity of water which they must carry in response to the rhythm of the tide. (Sinha - OEIS) W74-03621

HYDRAULIC MODEL TESTS OF ESTUARIAL WASTE DISPERSION,

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. For primary bibliographic entry see Field 05B. W74-03622 NEAR-SHORE CIRCULATION IN THE CALIFORNIA CURRENT, Scripps Institution of Oceanography, La Jolla, Calif

R. A. Schwartzlose, and J. L. Reid.

California Marine Research Committee, Cooperative Oceanic Fisheries Inventigation Report, Vol 16, p 57-65, 1972. 10 fig.

Descriptors: \*California, \*Coasts, \*Circulation, Currents (Water), Seasonal, \*Ocean currents, Pollution.

Identifiers: \*Near-shore circulation, Geostrophic flow, Davidson Current, Surface currents.

A brief review and discussion of near-shore circulation in the California Current presents charts which show a 16-year mean chart of the surface currents (relative to geostrophic flow) along the California coast in winter (January). The normal offshore flow all during the year is towards the southeast. In the wintertime the Davidson Current nearshore moves northward opposite to the current farther offshore. This northward flow in winter is attributed to the seasonal change in the wind patterns across California, Oregon and Washington. The winter winds are primarily from the south in the coastal area northward from San Francisco. (Sinha - OEIS)

THE ATYPICAL PHOSPHATE CYCLE OF ESTUARIES IN RELATION TO BENTHIC METABOLISM, Rhode Island Univ., Kingston. Narragansett

Rhode Island Univ., Kingston. Narragansett Marine Lab. For primary bibliographic entry see Field 05C. W74-03626

SELECTED LEGAL AND INSTITUTIONAL ASPECTS OF THE TEXAS COASTAL ZONE. Texas Law Inst. of Coastal AND Marine Resources, Houston. For primary bibliographic entry see Field 06E. W74-03630

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966, VOLUME I. For primary bibliographic entry see Field 08B. W74-03674

OBSERVATIONS OF THE TRANSFORMATION OF OCEAN WAVE CHARACTERISTICS NEAR COASTS BY USE OF ANCHORED BUOYS, Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 08B. W74-03676

RESPONSE CHARACTERISTICS OF UN-DERWATER WAVE GUIDE, Tokyo Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 08B. W74-03677

A POSSIBILITY OF GENERATION OF SURF BEATS, Tokai Univ., Tokyo (Japan). Coll. of Marine Science and Technology. For primary bibliographic entry see Field 08B. W74-0368.

A STUDY ON WAVE TRANSFORMATION IN-SIDE SURF ZONE, Tokyo Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 08B. ON A COEXISTENCE SYSTEM OF FLOW AND

WAVES, Kobe Univ. (Japan). Dept. of Civil Engineering. For primary bibliographic entry see Field 08B. W74-03688

SEDIMENT TRANSPORT AND ACCRETION AROUND THE COASTLINES OF JAPAN,
Western Australia Univ., Nedlands. Dept. of Civil

Engineering. R Silvester

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 29, p 469-488, 1967. 3 fig, 12

Descriptors: \*Sediment transport, \*Coasts, \*Waves (Water), Shoals, \*Littoral drift, Storms, Profiles, \*Erosion, \*Sedimentation. Identifiers: \*Japan (Inland Sea), Wave climate, Swell

The transport of material by waves is an important aspect of the overall movement to a destination of either coastal plain or offshore shoal. The persistent occurrence and direction of ocean swell make this wave domain the most important in this process. In enclosed seas littoral drift is effected by storm type waves, per medium of a different beach profile from that on oceanic margins. Accepting that the wave climate has not changed significantly over geologic time, it is possible to picture the geomorphology of river and coastal plains to the present continental outline. The coastlines of Japan are examined with such an emphasis. Lowland so formed is of extreme economic importance. In order to promote accretion of further areas on a large scale, the character of the sedi-ment and of the natural forces available at any location must be considered. Suitable structures and their siting within natural shoreline features are discussed. (See also W74-03674) (Sinha-OEIS) W74-03690

### MODEL STUDY ON THE FILLING-UP OF A FISHERY HARBOR BY DRIFTING SAND,

Kyoto Univ. (Japan). Disasters Prevention Research Inst. H. Noda.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 34, p 564-594, 1967. 19 fig, 1 tab, 8 ref, 1 plate.

Descriptors: \*Harbors, \*Estuaries, Sedimentation, \*Sediment transport, \*Currents (Water),
\*Waves (Water), Suspended load, \*Coasts, Model tion,

Identifiers: Wave height, Oscillations, Japan.

Field investigations and model experiments are described whose purpose was both to discover the mechanism of the movement of coastal material and its deposition in harbor basins and to consider some protective measures which might be taken against the filling-up of basins by drifting sand. From the viewpoint of similarity for the falling velocity of bottom materials, vinvl pellets were used as the model sediment. In experiments the height of the deposition of sediment was measured, together with the direction and velocity of currents, while in various cases the wave height inside and outside the harbor was measured as a means of elucidating the behavior of drifting sand as it fills up a harbor basin. It is concluded from these experiments that the filling-up of a harbor basin can be reproduced quantitatively in a model and that currents induced in basins by waves and harbor oscillations may have an important bearing on the problem of filling-up. (See also W74-03674) (Sinha-OEIS) W74-03691

A PETROGRAPHIC STUDY ON LITTORAL DRIFT ALONG THE ISHIKAWA COAST, JAPAN, Senshu Univ., Tokyo (Japan).

M. Aramaki, and S. Takayama.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 36, p 615-631, 1967. 11 fig. 1

Descriptors: \*Littoral drift, \*Sediment transport, \*Beaches, Profiles, Storms, \*Sedimentation, \*Waves (Water), Slopes.

Identifiers: \*Japan (Ishikawa Coast), Wave steep-

Based on the longitudinal variation series in various properties of beach sediments and topographic profiles along the southern coast of Ishikawa Prefecture, Japan, the prevailing direction and mechanism of littoral drift are discussed. The principal source of the beach material along the southern Ishikawa coast is the river Tedori. The beach material moves predominantly towards the southwest. The results of the survey of beach profiles at three hour intervals revealed the pronounced erosion of beach, i.e. waves cut away a vertical thickness of 1.5 meters of the beach material and overall landward retreat of waterline amounted to 16 meters during the passage of a depression. The beach changes associated with the ge of periodic local storms cause a drastic cut and fill of the beach in a short period of time. The largest wave was some 2 meters in wave height 8.5 seconds in wave period. Also, the erosi and deposition on the beach might be decided by the scale of wave, e.g. the wave steepness. (See also W74-03674) (Sinha-OEIS)

### TRANSPORT PATTERNS IN THE CHAO PHYA ESTUARY

Waterloopkundig Laboratorium, Delft (Nether-

E. Allersma, A. J. Hoekstra, and E. W. Bijker. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 37, p 632-650, 1967. 9 fig.

Descriptors: \*Estuaries, \*Sediment transport, \*Harbors, River flow, Sand bars, Hydrography, Flocculation, \*Sedimentation, Tidal effects, Model studies

Identifiers: Sea state. \*Thailand (Chao Phya

The port of Bangkok, the main gateway for traffic into Thailand, is situated in the estuary of the Chao Phya River. Increasing navigation demands improvement of the harbor and its 55 km long approach channel but the interests of agriculture and municipal water supply must also be taken into account. The Netherlands Engineering Consultants (NEDECO) in combination with the Delft Hydraulics Laboratory have made a four-year study of the estuary covering a field survey and a hydraulic model test. The observations in nature served to obtain insight into the estuarine transport pattern in relation with the boundary conditions given by the regimen of the river and the state of the sea. The small scale tests gave indications of the changes in these phenomena to be expected from alterations of the situation in the estuary and of the discharge characteristics of the river. (See also W74-03674) (Sinha-OEIS) W74-03693

### LITTORAL BYPASSING AND BEACH RESTORATION IN THE VICINITY OF PORT HUENEME CALIFORNIA, Army Engineer District, Los Angeles, Calif.

Coastal Engineering Branch. For primary bibliographic entry see Field 08B. EQUILIBRIUM FLOW AREAS OF TIDAL IN-

LETS ON SANDY COASTS, California Univ., Berkeley. Coll. of Engineering. For primary bibliographic entry see Field 08B.

### SUSPENDED SEDIMENT IN A TIDAL ESTUA-

Liverpool Univ. (England), Dept. of Civil En-

gineering.

A. R. Halliwell, and B. A. O'Connor.

A. R. Halliwell, and B. A. O'Connor. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 40, p 687-706, 1967. 9 fig, 1 tab,

Descriptors: \*Estuaries, \*Tides, \*Sediment transport, \*Suspended solids, Salinity, Temperature, Hydraulics, Density, Mixing, Seasonal, \*Littoral drift, \*Waves (Water).
Identifiers: \*Mersey Estuary (England), Tidal

range, Wave action.

A brief description is given of work being carried out in the Mersey Estuary, England. Attention is drawn to the factors influencing the sediment movement and the variables, such as velocity, suspended solids, salinity and temperature that must be measured in order to define the sedimen-tation complex adequately. A study is made of the effect of variations in temperature and tidal range upon the mean concentration of suspended solids observed at stations in the Estuary; the relationship proposed is of the form  $C \pm A + (B+CT)R +$ DT, where A, B, C and D are constants, R is the tidal range and T is the water temperature. The vertical distribution of suspended sediment is discussed and examples given which do not con-form to existing theory. Variations in the vertical distributions of sediment along the Estuary are examined and explained theoretically by reference to the existing bed conditions and hydraulic characteristics of the Estuary. See also W74-03674) (Sin-W74-03696

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966. VOLUME II.

For primary bibliographic entry see Field 08B. W74-03699

HYDRAULIC SURVEY AND MODEL IN-VESTIGATION OF THE INNER RANA FJORD, Norges Tekniske Hoegskole, Trondheim. River and Harbor Lab.

and naroof Lab.

T. Carstens, and A. Traetteberg.

In: Proceedings of Tenth Conference on Coastal
Engineering, Tokyo, Japan, September 1966,
American Society of Civil Engineers, New York,
Vol 2, Part 4, Chap 74, p 1313-1330, 1967. 10 fig, 5

Descriptors: \*Fjords, \*Stratification, Physiography, \*Sediment transport, \*Tidal effects, River flow, Density stratification, Salinity, Estuaries. Identifiers: \*Norway (Rana River).

The characteristic feature of the water masses in a fjord is their stratification. This stratification and its annual cycle are explained in terms of the physiography of the fjord regions. The glacial origin of these regions is outlined in order to study the sediment sources and the present sediment regime. A case study of a fjord in Northern Norway is reported. The results of a field survey comprising measurements of tidal and river flows are given. The measurements revealed that the tidal flow had a steady component giving a horizontal circulation in the fjord, in addition to the vertical circulation associated with the diffusion of salt water upwards into the surface layer. A reduced scale model of the lower river and the Inner Fjord was built to avoid adverse affects of a constriction

### Group 2L—Estuaries

of the river mouth. The model also showed that a small jetty would turn the turbid surface jet away from the incoming tidal current towards the outbound current caused by the horizontal circulation, thereby relieving the harbor area of some of its present sediment supply. (See also W74-03699) (Sinha-OEIS) W74-03701

SALINITY DISTRIBUTION AND EFFECT OF FRESH WATER FLOWS IN THE HOOGHLY RIVER.

Central Water and Power Research Station, Poona

(India).

C. V. Gole, and P. P. Vaidyaraman.
In: Proceedings of Tenth Conference on Coastal
Engineering, Tokyo, Japan, September 1966,
American Society of Civil Engineers, New York,
Vol 2, Part 4, Chap 79, p 1412-1434, 1967. 12 fig, 2
tab, 4 ref.

Descriptors: \*Estuaries, \*Saline water intrusion, Sedimentation, Water supply, Potable water, \*Saline water - freshwater interfaces, Freshwater, River flow, Circulation, Bores, Sea water, Salinity.

Identifiers: \*India (Hooghly River), India, Freshwater flows, Shoaling, Freshets.

An examination of the hydraulic characteristics of the Hooghly River with particular reference to the pattern of salinity intrusion and the effects of fresh water flows has been made. The conditions prevailing are such that during the brief period of fresh water flows the problem of salinity intrusion is absent. The beneficial effect of fresh water flows in improving the navigable depths along the river is also shown. The cessation of fresh water flows causes the deterioration of navigable depths due to the landward movement of sediment: it also results in the upstream encroachment of salinity affecting the supply of drinking water to the City of Calcutta. Even during the period in the freshet when the salinity profiles exist the estuary remains well-mixed. The need for augmentation of fresh water flows for improving the conditions has also been brought out. (See also W74-03699) (Sinha-W74-03702

STUDIES ON SALT WEDGE BY ULTRASONIC

METHOD, Hokkaido Univ., Sapporo (Japan). Dept. of En-

gineering Science.

H. Fukushima, M. Kashiwamura, and I. Yakuwa.

In: Proceedings of Tenth Conference on Coastal
Engineering, Tokyo, Japan, September 1966,
American Society of Civil Engineers, New York,
Vol 2, Part 4, Chap 80, p 1435-1447, 1967. 15 fig, 11
ref.

Descriptors: \*Estuaries, \*Saline water intrusion, Saline water - freshwater interface, \*Ultrasonics, Mixing, Internal waves, \*Stratified flow. Identifiers: \*Japan (Ishikari River), \*Salt wedge.

A series of observations and studies have been made on the salt wedge at the Ishikari River. As a new technique of detecting a salt wedge, the ultrasonic method was used, which is the same with an echo-sounder in principle but of particularly high sensitivity. The record presents a detailed profile of a salt wedge as well as some dynamical behaviors, namely, a stability or a mixing process of a longitudinal change of a thickness of the fresh water, an internal jump or an internal wave, etc. The ultrasonic method is very useful for a study of the salt wedge and even a common stratified flow. (See also W74-03699) (Sinha-OEIS)

PREDICTED FLUSHING TIMES AND POLLU-TION DISTRIBUTION IN THE COLUMBIA RIVER ESTUARY,

Oregon State Univ., Corvallis. Dept. of Oceanography.

For primary bibliographic entry see Field 05B.

W74-03704

PRELIMINARY RESULTS AND COMPARISON OF DYE TRACER STUDIES CONDUCTED IN HARBORS, ESTUARIES, AND COASTAL WATERS.

Naval Oceanographic Office, Washington, D.C. For primary bibliographic entry see Field 05B. W74-03705

RESPONSE CHARACTERISTICS OF TOKYO BAY TO INCIDENT LONG WAVES,

Central Research Inst. of Electric Power Industry, Tokyo (Japan). M. Hino, and K. Hino.

Coastal Engineering in Japan, Vol 8, p 57-69, December 1965. 18 fig, 8 ref.

Descriptors: \*Waves (Water), Statistical methods, \*Harbors, Numerical analysis, Equations, Coastal structures, Resonance, Energy, Estuaries, \*Seiches, \*Storm surges, \*Shore protection. Identifiers: \*Japan (Tokyo Bay), Harbor paradox, conditions, Incident, waves, \*Long

Identifiers: \*Japan (Tokyo Bay), Harbor paradox, Boundary conditions, Incident waves, \*Long waves, Periodicity, Inertial terms, Nonlinear terms.

Response characteristics of Tokyo Bay to long waves are investigated by a numerical experiment. The experiment was completed by only one run with use of the statistical concepts, instead of repeating, as usual in laboratory experiments, the same kind of response calculations to sinusoidal waves with differing wave length. Results and conclusions are: Although the incident waves seem to propagate towards the innermost coast as if there were no boundaries, the correlation functions show that waves with long period are almost completely reflected at the innermost coast of the bay. The dike which is planned at the central portion for storm surge protection reduces greatly the arrival of the wave front. The predominant reso-nant periodicity is about 60 min to 90 min and its harmonics. The periodicity coincides with the field observation. Consequently, it is anticipated and, in fact, sometimes experienced that extraneous high water levels occur, especially, superposed on storm surges, by resonant action with winds or presure fluctuations and incident waves such as 'Tsunami'. The construction of the dike will not change considerably the response characteristics. That is, the 'harbor paradox' is scarcely expected. Waves with longer periodicities transport the energy from the entrance inwards, while waves with shorter periodicities play a role to dissipate the energy by the frictional force. The nonlinear terms (inertial and non-linear friction term) act to transport the energy of the waves with lower frequency to waves with high frequency. The process is the same as the mechanism of turbulent shear flow field. Further calculations are needed by inserting a 'mathematical wave filter' at the entrance of the bay to exclude the effect of re-reflection of waves. (Sinha-OEIS) W74-03706

CHARACTERISTICS OF SEDIMENTARY EN-VIRONMENTS IN MORICHES BAY, California Univ., Los Angeles.

M. M. Nichols.

In: Paper in Marine Geology Shepard Commemorative Volume, 1964. (R. L. Miller, ed.) Chapter 16, p 363-383, 11 fig, 1 tab, 13 ref.

Descriptors: \*Estuaries, Hurricanes, Tidal effects, Floods, \*Barrier islands, \*Sedimentation, \*Bays, Texas, \*New York, Environments. Identifiers: Moriches Bay (NY).

The intent is to describe the environments of deposition in Moriches Bay and to relate the dis-tribution pattern of recent sediments to their general conditions of formation. The results provide an interesting comparison with the bays in Texas, and should aid in a broader understanding of ancient lagoon environments. In its general setting on a coastal plain, Moriches Bay has much in common with bays along the central Texas coast ar Rockport. It lies behind a barrier island lel to the coast and has a small tidal range. Like the Texas area, Moriches Bay is subject to short-term fluctuations in the environment. Storm tides, hurricanes, and floods from the land occur at times in both; whereas the Texas region has excessive droughts, Moriches is susceptible to frequent winter freezes. Gross features of the sediments at Moriches are comparable to those in the Texas bays. Contrasts become apparent when sediment characteristics are examined in detail and when sediment sources are considered. (Sinha-OEIS) W74-03707

### MODELS PREDICT ENVIRONMENT.

Sea Frontiers, Vol 16, No 6, p 352-356, November-December 1970. 4 photo.

Descriptors: "Water control, "Water management (Applied), "Estuaries, "Model studies," "Hydraulic models, Water, Water conservation, Water distribution, Flood control, Water levels, Water level fluctuation, Research facilities, Dredging, Dikes, Thermal pollution, Flow.

The Army Corps of Engineers' manipulation of the coastal environment has been tested, in miniature, for two decades at the Waterways Experiture, for two decades at the waterways Experi-ment Station in Vicksburg, Mississippi. Physical changes in estuaries caused by such things as channel dredging, construction of dikes and causeways, and closure of secondary channels, have had major effects on hydraulic, salinity, and flushing characteristics of the estuaries involved, and those effects can be studied in the models. Tests in models can help locate the best sites for open water spoil disposal to prevent deposition of the spoil on sensitive zones of the estuary. Long-range schemes are under consideration for redistribution of flow among river basins to increase water supplies to dry areas. Models are also used to study thermal waste diffusion and recirculation of heated waste as larger electrical power plants are constructed. While land reclamation in estuahas been heavily criticized, hydraulic models can be used for quantitative determination of the effects of such projects on tidal and salinity conditions in the estuaries involved. (Ritchie-Florida) W74-03713

STUDY OF A POLLUTED ENVIRONMENT (THE OLD PORT AREA OF MARSEILLES): THE INFLUENCE OF PHYSICAL AND CHEMICAL CONDITIONS ON THE CHARACTERISTICS OF THE POPULATION OF THE QUAY, (IN FRENCH), Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.

Centre d'Oceanographie, Marseille (France). Sta tion Marine d'Endoume. For primary bibliographic entry see Field 05C. W74-03719

### 03. WATER SUPPLY AUGMENTATION AND CONSERVATION

### 3A. Saline Water Conversion

DEEP-WELL INJECTION OF DESALTING--PLANT WASTE BRINE, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 05E. METHOD AND APPARATUS FOR PURIFYING

SEA WATER, Max-Planck-Gesellschaft zur Forderung der Wis-senchaften e.v., Goettingen (West Germany). (As-

G. Huckstedt, and H. Jakobs.

U.S. Patent No. 3,772,192, 4 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 663, November 13, 1973.

Descriptors: \*Patents, Copper, Sea water, \*Desalination, Foam separation, Pollution abatement, Separation techniques, Equipment, \*Water purification, \*Suspended solids, \*Organic matter, Heavy metals, \*Ions.

Identifiers: \*Sea water purification, Suspended organic matter, Froth separation.

A method and apparatus for purification sea water contaminated with ions of a heavy metal and/or suspended organic matter is described. Because of its salt content, sea water tends to froth or foam under the action of air even in the absence of sur-face active agents. When trace amounts of suspended organic matter of relatively high molecular weight or minute amounts of heavy metal ions such as copper are present in the raw water, the froth accumulates the contaminants at the liquid-gas interface of the bubbles in the froth. Apparatus includes an expansion vessel, a mixing device for intimately mixing the water to be purified with air, a feeding device for feeding the resulting mixture of water and air to the expansion vessel under a pressure higher than the pressure in the vessel, and an outlet on the bottom portion of the vessel for withdrawing purified water. A tubu-lar riser extends upward from the vessel for receiving the froth which is generated by expansion of the water/air mixture in the vessel. The froth is released from a portion of the riser space remote from the expansion vessel in an unward direction. A rinsing device is provided for applying a film of liquid to an inner face of the riser while keeping the remainder of the space in the riser substantially free from the liquid. (Sinha-OEIS) W74-03654

CONTAINING AND REMOVING OIL SPILLS ON WATER.

Phillips Petroleum Co., Bartlesville, Okla. (as-

H. E. Alquist, and R. T. Werkman.

U.S. Patent No 3,770,627, 2 p, 1 tab, 3 ref; Official Gazette of the United States Patent Office, Vol 916, No 1, p 251, November 6, 1973.

Descriptors: \*Patents, Oil pollution, \*Oil spills, \*Crude oils, \*Pollution abatement, Water pollution control, Water quality control, Water treatment, Separation techniques.

A method is provided to produce a coherent mass containing oil in such a form that it can be removed from a water surface. It consists of applying to the surface of the oil (1) a particulate thermoplastic, organic polymer of particle size less than 10 mesh and of sufficient density to float on the oil and (2) an inflammable substance, igniting the inflammable substance to fuse the polymer, thereby forming a coherent mass of fused polymer containing the oil. The fused mass can be easily skimmed from the water surface. Suitable fiammable materials which can be used are identified as hydrocarbons in the kerosene boiling range (250 to 500 deg F). (Sinha - OEIS)

THE OPTIMAL TIME TO START THE OPERA-TION OF A DESALTING PLANT IN ISRAEL,

Tel-Aviv Univ. (Israel). Dept. of Economics. G. Fishelson.

Water Resources Bulletin, Vol 9, No 4, p 801-815, 1973. 3 fig. 2 tab. 14 ref.

Descriptors: Water supply, \*Water demand, Dynamic programming, \*Optimization, \*Desalination plants, Agriculture.

Identifiers: \*Israel.

The recognition of water as the limiting resource in Israel's agricultural development has led to the use of many water-saving techniques and the exploration of nonconventional sources of water, such as desalting. This study attempts to determine the op-timal time to start a desalting operation. A supply function for aggregate agricultural production is derived from a constant elasticity of substitution (CES) function using water and a composite good as inputs. The intersection of demand and supply yields a sequence of equilibrium prices, quantities, and marginal value products for water (MVP) from which the optimal time can be determined. A modified form of MacAvoy and Peterson's cost modified form of MacAvoy and Peterson's cost estimates is used. The assumption of a single technically available plant size introduces the problem of indivisibility, modifying the optimality rule by the equating of per unit costs of production to average MVP of the additional water at year t. Following this approach, the optimal time occurs in 46-47 years. New plants become optimal every two-three years. Within 20 years the amount of water used in agricultural production would be equal from conventional and nonconventional sources. Technical innovation would lower cost of desalting, allowing construction within a 30 year period but increasing the time interval between ad-ditional plants. (Schroeder-Wisconsin) W74-03750

### 3B. Water Yield Improvement

THE EFFECTS OF WATER CONSERVATION WORKS ON THE REGIME OF MORECAMBE

Hydraulics Research Station, Wallingford, (En-

gland). For primary bibliographic entry see Field 04A. W74-03483

THE CALIFORNIA STATE WATER PROJECT

California State Dept. of Water Resources, Sacramento. For primary bibliographic entry see Field 06B. W74-03502

### 3C. Use of Water of Impaired **Ouality**

THE EFFECTS OF SURFACE IRRIGATION WITH DAIRY MANURE SLURRIES ON THE QUALITY OF GROUNDWATER AND SURFACE

Tennessee Univ., Knoxville. Dept. of Agricultural

Engineering. For primary bibliographic entry see Field 05B. W74-03339

PROPOSED MUNICIPAL WASTE WATER--GROUNDWATER EXCHANGE, CITY OF TUCSON: AVRA-MARANA VALLEY

Arizona Water Resources Research Center, Tucson; and Arizona Agricultural Experiment Station, For primary bibliographic entry see Field 05G. W74-03340

OPTIMIZING WATER USE: THE RETURN FLOW ISSUE,

Colorado Univ., Boulder. School of Law. For primary bibliographic entry see Field 06E. W74-03385

RECYCLING ON THE LAND: AN ALTERNA-TIVE FOR WATER POLLUTION CONTROL, Natural Resources Defense Council, Washington, D.C. Project on Clean Water.
For primary bibliographic entry see Field 05D. W74-03387

SUITABILITY OF FOOD PROCESSING WASTE

WATER FOR IRRIGATION, Agricultural Research Service, Norfolk, Va. For primary bibliographic entry see Field 05D. W74-03482

CONVENTIONAL TREATMENT METHODS FOR PULP AND PAPER MILL WASTES AND DISPOSAL ON LAND FOR IRRIGATION, Nagpur (India).
For primary bibliographic entry see Field 05D.
W74-03547 Central Public Health Engineering Research Inst...

### 3D. Conservation in Domestic and **Municipal Use**

COMPARATIVE ANALYSIS OF RESIDENTIAL WATER USE IN PUERTO RICO, Puerto Rico Univ., Mayaguez. Water Resources

Research Inst.
For primary bibliographic entry see Field 06D.
W74-03324

HUMAN FACTORS INVOLVED IN THE DEVELOPMENT OF A WATERSHED IN YABU-

Puerto Rico Univ., Mayaguez. Water Resources Research Inst.

For primary bibliographic entry see Field 06B. W74-03325

THE IMPACT OF POLICY VARIABLES ON RE-SIDENTIAL WATER DEMAND AND RELATED INVESTMENT REQUIREMENTS.

Toronto Univ. (Ontario). Inst. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 06D. W74-03477

A GUIDE TO DECISION MAKING FOR WATER RESOURCES MANAGEMENT IN THE SAN AN-TONIO REGION.

San Antonio River Authority, Tex.
For primary bibliographic entry see Field 06B. W74-03484

MASTER PLAN FOR WATER SUPPLY, BUCKS COUNTY, PENNSYLVANIA, 1970. Justin and Courtney, Philadelphia, Pa.

Prepared for the Bucks County Planning Commission, Doylestown, Pa. May 1, 1972. 33 p, 24 fig, 8 tab, 136 ref, 7 append.

Descriptors: \*Planning, \*Water supply, Ground-water, \*Delaware River, \*Pennsylvania, Costs, Water pollution, Carbonates, Low-flow augmenta-tion, \*Water pollution control. Identifiers: Utility extension, Bucks County (Penn.), Neshaminy Creek (Pa).

Optimal water supply facilities, assuming a policy of enhancing economic growth, are projected for suburban-rural Bucks County. Criteria for projec-tion of facilities were based on population projection, analysis of existing water supply requirements, availability of water as indicated from this and previous studies, and project design criteria from this and previous studies. Development intervals are 1975, 1990, and 2010. Groundwater, estimates as providing 50% of Bucks County's water is the least expensive supply of drinking water, and will be used whenever yield and quality are satisfactory. Availability is uncertain, future wells are called for, but available groundwater supply is shown as constant at present levels in a pictogram. Contamination by coliform organisms apparently

### Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3D—Conservation in Domestic and Municipal Use

caused by housing and industrial development is evident at various locations in the Carbonate formations. Surface water sources will be the Delaware River and two multi-purpose reservoirs on tributaries of Neshaminy Creek. To augment the reservoirs at low-flow periods, water will be pumped from the Delaware. Water supply treatment facilities will be located below the reservoirs near Langhorne and New Britain. The county is divided into 29 water supply sub-regions based on existing water systems or watersheds. Existing and projected water supply for each sub-region is analyzed until 2010. Costs of water supply are estimated for horizon years by sub-regions and by project. Water imports and exports receive consideration. Several maps illustrate locations of projects. (Stein - North Carolina) W74-03629

THE GREAT MIAMI RIVER CORRIDOR STU-DY: A CONCEPT PLAN.

DY: A CONCEPT PLAN.
Kiley (Dan) and Partners, Charlotte, Vt.
For primary bibliographic entry see Field 06F.
W74-03631

NATURAL FEATURES ELEMENT OF THE COMPREHENSIVE PLAN: A PLAN FOR ACTION.

DeKalb County Planning Dept., Decatur, Ga. For primary bibliographic entry see Field 04C. W74-03633

CONSERVATION-OPEN SPACE PLAN; AMENDMENTS TO THE SPRINGFIELD COM-PREHENSIVE PLAN. Springfield Planning Dept., Mass.

May, 1972, 23 p, 1 append.

Descriptors: \*Conservation, \*Wetlands, Planning, Recreation, Parks, \*Land use, Marshes, Environmental effects, Soils, Natural resources, Water resources, Wildlife, \*Massachusetts, Ponds, Rivers, Lakes, Streams, \*Comprehensive planning.

Identifiers: \*Open space, Soil Conservation Service, Springfield (Mass.), Water-oriented recreation, Streambelt network.

A Conservation Commission was established in Springfield in 1960 to protect and develop the natural resources of the city. Since then the Commission has acquired about 200 acres of natural land and kept it essentially open. The acquisitions were largely based on the City's comprehensive plan. The goals, data, and criteria being used by the Commission to select new sites for acquisition are discussed. Goals include the preservation of land for public access to lakes and streams, preservation of wetlands to control runoff and prevent flooding, preservation of land for recreation and natural beauty, and preservation of land for wildlife habitats. Data for the analysis of possible sites come largely from two Soil Conservation Service studies: a detailed soil survey covering soil types, slopes, and water table levels; and a natural resources inventory identifying all remaining natural areas in the city. Twenty-one specific sites are recommended to be acquired: eight are marshes, swamps, and bogs; six are located along streams; and seven are to be used for access to recreational lakes and rivers. Additional areas to be included in the open space-recreation category pending further investigation or changing conditions are identified. Implementation of acquisition phase will be a development phase including preparation of use plans for each site and a maintenance phase with provisions for periodic maintenance. Financial considerations encompass a fair market value for the land and federal and state cost sharing programs. (Elfers - North Carolina) W74-03634

WATER STUDY, SANTA FE PLANNING AREA. Santa Fe City Planning Dept., N. Mex. For primary bibliographic entry see Field 04B. W74-0364.

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME 1: METHODOLOGY ANALYSIS OF WATER RESOURCE AREAS.

Alamo Area Council of Governments, San Antonia, Tex.
For primary bibliographic entry see Field 06B.
W74-03642

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME II: URBAN WATER-RELATED SERVICES.

Alamo Area Council of Governments, San Antonio, Tex.
For primary bibliographic entry see Field 06B.
W74-03643

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION,

VOLUME III: SHORT RANGE PROGRAM 1970-1975. Alamo Area Council of Governments, San Antonio, Tex.

For primary bibliographic entry see Field 06B. W74-03644

WATER FACILITIES FOR EAST ORANGE AREA FOR CITY OF ORANGE AND EAST ORANGE COUNTY WATER DISTRICT. Boyle Engineering, Santa Ana, Calif.

Engineering Report. February, 1973. 93 p, 16 fig, 46 tab, 2 append.

Descriptors: "Water supply, "Water sources, "Coordination, "Water quality control, Water storage, Water transfer, Water demand, Cost analysis, Environmental effects, Administration, Joint costs. "California.

Identifiers: Orange County (Calif.), Joint facilities, California water project.

Availability of water from the Metropolitan Water District of Southern California via the Santiago Lateral, the new possibilities of coordinating the construction and use of water supply facilities with other local water supply agencies, and the increased concern for an evaluation of environmental impacts of the proposed plans made it necessary to re-evaluate alternatives presented in an earlier document. New alternatives are summarized and a new program for orderly development of water facilities is presented. It includes sections on existing facilities, future growth and water demand, available water supply sources and their quality, and proposed water supply facilities and estimated costs. New recommendations and alternative plans are largely based on anticipated coordination between the city or Orange and the East Orange County Water District, the city of Anaheim, the Irvine Ranch Water District, and the Municipal Water District of Orange County. Some of the possible plan elements are the utilization of East Orange County Feeder No. 2, the construction of new wells, the joint construction, with two other agencies, of a new water treatment plant, and the purchase of storage capacity in the Santiago Reservoir. Advantages and disadvantages of these actions are outlined. Extensive tables and figures supplement the report. Discussion of environmental impact appears in Appendix B. (Elfers-North Carolina) W74-03648

2020 PLAN, BOARD OF WATER SUPPLY/CITY AND COUNTY OF HONOLULU. Honolulu City and County Board of Water Supply, Hawaii. For primary bibliographic entry see Field 04B. W74.03469.

COMPREHENSIVE WATER SYSTEMS NEEDS PLAN, 1970-2000, ALLEGHENY COUNTY, PENNSYLVANIA.
Green Engineering Co., Sewickley, Pa.

Prepared for Allegheny County Board of Commissioners. April, 1972. Vol. I, 114 p, 58 fig, 1 append. Vol II-35 plates.

Descriptors: Planning, "Water supply, Administration, "Comprehensive planning, "Water demand, Water quality control, "Projections, Urbanization, Geology, Coordination, "Water demand, Financing, "Pennsylvania, Cost analysis. Identifiers: Allegheny County (Pa.), Water system expansion, Pittsburgh (Pa.).

As one integral element in the comprehensive planning program of the Allegheny County Planning Department, the purpose of this report is to assist the County commissioners in determining financing commitments for the expansion of the county's water supply systems. The report consists of three basic parts: (1) an inventory of exist-ing water supply treatment, storage, and distribution facilities, with characteristics of individual systems detailed; (2) an appraisal of the raw water resources including sections on geology and water quantity and quality; and (3) an identification of future water supply needs and plans based on various considerations such as projected population trends for each service area using a computer model to determine realistic projections plus economic growth trends. Some basic conclusions and recommendations include: (1) the county has ample sources of raw water (e.g. the Allegheny, Monongahela, and Ohio Rivers) but water quality is very important. Recommended: Pollution abatement should be accelerated through increased assistance from municipal, county, state and federal governments; (2) the northern part of the county will require a major new water intake from the Allegheny River. Recommended: Investigate development of new system to serve this area; (3) the county should take the lead in developing a county-wide approach to the planning and administration of all water supply systems. Based on present day construction costs it is estimated that a total of \$150 million will be required by the year 2000 for the recommended facilities. (Elfers-North Carolina) W74-03650

WATER CONTROL APPARATUS RESPONSIVE TO LEAKAGE OR OVERFLOW CONDITIONS, For primary bibliographic entry see Field 04A. W74-03663

### 3E. Conservation in Industry

THE ECONOMIC IMPACT OF A DEEPWATER TERMINAL IN TEXAS, Texas A and M Univ., College Station. Industrial Economics Research Div. For primary bibliographic entry see Field 06B.

CLOSED WATER CIRCUITS IN A PAPER MILL PROCESSING WASTE PAPER, Technische Universitaet, Darmstadt (West Germany). Wasser- und Abwasserforschungsstelle. For primary bibliographic entry see Field 05D. W74-0354.

### 3F. Conservation in Agriculture

DESIGN AND OPERATION OF LAND TREAT-MENT SYSTEMS FOR MINIMUM CON-TAMINATION OF GROUNDWATER, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 05D. W74-03223

SATURATED WATER FLOW THROUGH CLAY

POTS, Illinois Univ., Urbana. Dept. of Plant Physiology and Horticulture.

L. A. Spomer. Soil Sci Soc Am Proc. Vol 36, No 6, p 976-978.

1972 Illus Identifiers: \*Clay pots, Drip irrigation, Electrolytic tanks, Flood irrigation, \*Irrigation, \*Water

An electrolytic tank electric analog was used to An electrostic tank electric analog was used to simulate saturated water flow through standard clay pots during both flood and drip irrigation. Simulated flow patterns indicated significant zones of low flow rates, particularly during drip irrigation.—Copyright 1973, Biological Abstracts, W74-03306

MANAGEMENT SCIENCE IN THE DEVELOP-ING COUNTRIES: A COMPARATIVE AP-PROACH TO IRRIGATION FEASIBILITY, Italconsult, Rome (Italy).

C. I. Rose. Management Science, Vol 20, No 4, p 423-438, December, Part I, 1973. 7 fig, 5 ref.

Descriptors: \*Irrigation, \*Feasibility studies, \*Operations research, \*Management, Agriculture, Economics, Rivers, Decision making, Constraints, Methodology, Crops, Natural resources, Mathe-

Matcal involves: \*Developing countries, \*Burma, Mixed integer programming, Water availability, Mu River (Burma).

An irrigation feasibility study is described in which systems analysis methods were used to select for a well-defined geographical area an irrigation system best suited to both local and national needs. The problem was to decide what major works to build and crops to grow to make optimal use of the available natural and human resources. the availability of water being a prime consideration. The area examined comprises some one million acres of land in Burma, and the study was undertaken for the Burmese Government under the auspices of the United Nations. The solution technique used was mixed integer programming in order to be able to handle some 750 continuous variables, 50 integer variables, and 250 constraints. This paper reports on a specific project, the Mu River Valley Multipurpose Scheme, and is divided into three sections: the real problem description, adoption of solution approach, and study results. The problem was solved using both conventional and operations research methods in-dependently; a complete comparison of the relative merits of both approaches is considered in detail. The advantages arising from the use of a mathematical model are considerable. (Bell-Cornell) W74-03471

PHYSIOLOGY OF DROUGHT RESISTANCE IN THE SOYBEAN PLANT (GLYCINE MAX): I. THE RELATIONSHIP BETWEEN DROUGHT RESISTANCE AND GROWTH, Sheffield Univ. (England). Dept. of Botany. D. J. Read, and E. M. Bartlett. J Appl Ecol. Vol 9, No 2, p 487-499. 1972, Illus.

Identifiers: \*Drought resistance (Plants), Glycine-Max, Growth rates, Plant physiology, \*Soybean growth, \*Soil water, Root systems, Cytokinins.

Root and shoot growth of the soybean was compared over a range of soil water potentials. Small decreases in soil water potential induced large increases in root:shoot ratio. This increase was not, however, accompanied by a large reduction of total yield. With an increase of soil moisture stress the unit leaf rate increased and the leaf area ratio decreased. The reduced soil moisture potential stimulated leaf water deficits in the early stages of treatment and these deficits appeared to initiate the modification of root:shoot balance. The increase of water uptake by the larger root system and the reduction of loss from the smaller shoots enabled a balance to be achieved between uptake and loss at any given soil moisture potential so that water deficits were eliminated. The increase in leaf rate may be stimulated by an increase in the effective concentration of root-synthesized cytokinins reaching the shoot. Drought resistance in the soybean is based upon avoidance, but a larger variety of avoidance mechanisms are involved than has been previously postulated.—Copyright 1973, Biological Abstracts, Inc. W74-03476

ECONOMIC BENEFITS FROM IRRIGATION, Texas Tech Univ., Lubbock. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 06C. W74-03487

SOIL SURFACE ROUGHNESS AND STRAW MULCH FOR MAXIMUM BENEFICIAL USE OF RAINFALL BY CORN ON A BLACKLAND

SOIL, Agricultural Research Service, State College,

D. L. Myhre, and J. O. Sanford. Soil Sce Vol 114, No 5, p 373-379, 1972. Illus. Identifiers: Beneficial use, Capacity, \*Corn, Rainfall, \*Soil (Blackland), \*Straw mulch treatment, Water transfer, Zea-Mays, Soil surface roughness.

Two straw mulch treatments (0 and 4484 kg/ha) and 3 soil surface conditions in the interrow (smooth, rough at emergence, and rough at 50 cm plant height) were evaluated in factorial combinaplant neight) were evaluated in tactorial combina-tion over a 3 yr period using 2 cultivars of Zea mays in a 6 x 6 latin suqare. The experiment was located on a Blackland soil, Catalpa clay loam, which had an available water-holding capacity of 17 cm in the top 150 cm. Straw mulch and early soil surface roughness increased water content in the soil profile, but the mulch was more effective in increasing grain production. Mulching the soil surface increased water transfer rate during both depletion and secretion. The Mp305 X Mp307 grown under nonmulched, smooth surface conditions yielded 6899, 12105 and 8530 kg/ha in 1966. 1967, and 1968, respectively. An additional 1631, 251 and 1192 kg/ha were produced under the mulched, smooth condition during the 3 years. The late soil roughness treatment significantly reduced grain yields, probably because of root pruning and evaporative losses after the roughening operation. Similar, but smaller, treatment responses were obtained for the Funks G732 cultivar. Mulched rough soil surface help minimize soil water deficits and, therefore, reduce the risk when growing a crop without irrigation.—Copyright 1973, Biological Abstracts, Inc. W74-03515

EFFECTS OF REDUCING INTERPLANT COM-PETITION FOR LIGHT AND WATER ON STALK ROT OF CORN,

Department of Agriculture, Harrow (Ontario). Research Station. C. G. Mortimore, and L. F. Gates. Can Plant Dis Surv. Vol 52, No 3, p 93-96, 1972.

Identifiers: \*Corn stalk rot, Fungi, \*Light, Resistance, Susceptibility, Water, Zea-Mays, \*Plants

Stalk rot in resistant and susceptible corn (Zea mays) hybrids was studied under conditions of reduced interplant competition for light and water or for water only. A reduction in competition for both light and water decreased stalk rot by 64% and 20% in resistant and susceptible hybrids, respectively, when compared with plants for which stress conditions were not altered. Susceptible hybrids, especially in very dry periods, responded very little to reduced competition for water, and this appeared to limit their response to reduced competition for light. Resistant hybrids were more resilient than susceptible ones in that, when stress was decreased, they showed greater reductions in stalk rot. Susceptible plants tended to maintain yield at the expense of stalk deteriora-tion and susceptibility to stalk rot.--Copyright 1973, Biological Abstracts, Inc.

A CONVENIENTLY CONSTRUCTED DIVISOR FOR SPLITTING LOW WATER FLOWS, Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station. For primary bibliographic entry see Field 07B. W74-03522

THE SIGNIFICANCE OF THE FALLOW YEAR INTE SIGNIFICANCE OF THE FALLOW YEAR
IN THE DRY-FARMING SYSTEM OF THE
GREAT KONYA BASIN, TURKEY,
Agricultural Univ., Wageningen (Netherlands).
Dept. of Soils and Fertilizers.
B. H. Janssen.

Neth J Agric Sci, Vol 20, No 4, p 247-260, 1972, Il-

Identifiers: Annual, \*Dry farming, Fallow, Moisture, Nitrogen, Precipitation, Production, \*Transpiration, \*Turkey (Great Konya basin), \*Transpiration, \*T \*Wheat production.

The effect of the fallow year in the usual fallow-wheat rotation was studied. Between transpiration and dry matter production a linear relation was found. This relation in combination with the relations found between stored moisture and dry matter production allowed the calculation of the contribution of stored moisture to the wheat's contribution or stored moisture to the wheat ranspiration in the crop year. The contribution of stored moisture proved essential. A tentative scheme is presented showing the coherence between annual precipitation and the necessity of fallow and of N dressing.—Copyright 1973, Biological Abstracts Live. ical Abstracts, Inc. W74-03605

### 04. WATER OUANTITY MANAGEMENT AND CONTROL

### 4A. Control of Water on the Surface

SOCIAL COSTS AND BENEFITS OF WATER RESOURCE CONSTRUCTION, Kentucky Water Resources Inst., Lexington. For primary bibliographic entry see Field 06B. W74-03204

LEGAL FACTORS IN ECONOMETRIC MODELING OF LOCAL FLOODPLAIN MANAGEMENT DEVICES IN THE CONNEC-TICUT RIVER BASIN,
Massachusetts Univ., Amherst. Water Resources

Research Center.
For primary bibliographic entry see Field 06F.
W74-03207

### Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A-Control of Water on the Surface

MULTIPLE OUTLET SELECTIVE WITHDRAWAL TECHNIQUE FOR WATER OUALITY PREDICTION OF LAKE RELEASES, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 05B. W74-03218

HUMAN FACTORS INVOLVED IN THE DEVELOPMENT OF A WATERSHED IN YABU-

Puerto Rico Univ., Mayaguez. Water Resources Research Inst.

For primary bibliographic entry see Field 06B. W74-03325

THE GENERATION OF FLOOD DAMAGE TIME SEQUENCES,

Kentucky Water Resources Inst., Lexington. I. P. Breaden.

Available from the National Technical Information Service as PB-227 216, \$5.00 in paper copy, \$1.45 in microfiche. Research Report No. 32, 1973. 150 p, 16 fig, 4 tab, 30 ref, 3 append. OWRR A-006-KY (13). 14-31-0001-3017.

Descriptors: \*Flood control, \*Flood damage, Flood frequency, Estimating, \*Hydrograph analysis, Computer models, Computer programs, \*Time series analysis, \*Flood forecasting, \*Simulation analysis, Depth-area-duration analysis, Reservoir

There is a need in water resources planning to develop a procedure for determining the time pattern in which flood damages occur as a function of the rise and fall of the flood hydrograph. The widely-used approach for estimation of flood damages does not take into account the fact that the frequency of the annual flood peak may not be the same as the frequency of the total annual flood damages. As examples, several small storms during the year may do more damage than a single larger storm, or flood damages may be reduced by a reduction in flood duration rather than the flood peaks. A digital computer subroutine DAMAGE can be used to estimate the direct and indirect damages to property in the four basic categories of crop, field, urban, and public facilities as func-tions of the depth and duration of flooding, seasons, and the time laps between flood events.

DAMAGE may be called with recorded or simulated annual hydrographs and used to analyze the time pattern of damages in the flood plain for op-timizing the policies for operating reservoir flood control storage or for estimating the average annual damages for use in formulation of alternative flood control schemes. (Grieves-Kentucky) W74-03334

DAMS AND RESERVOIRS IN TEXAS: PART II. Texas Water Development Board, Austin. For primary bibliographic entry see Field 08A. W74-03375

OPTIMIZING WATER USE: THE RETURN

Colorado Univ., Boulder. School of Law. For primary bibliographic entry see Field 06E. W74-03385

STATEMENT FOR PUBLIC MEETINGS OF THE DEPARTMENT OF ARMY CORPS OF EN-GINEERS CONCERNING THE REFORMULA-TION OF THE SIXES BRIDGE, DAM, AND LAKE PROJECT MARYLAND, AND THE VERONA DAM AND LAKE PROJECT, VIR-GINIA.

Interstate Commission on the Potomac River Basin, Washington, D.C.
For primary bibliographic entry see Field 05G.

W74-03386

A BILL TO ESTABLISH A NATIONAL FLOOD PLAIN POLICY.
For primary bibliographic entry see Field 06E.

A BILL AUTHORIZING THE CONSTRUCTION, REPAIR, AND PRESERVATION OF CERTAIN PUBLIC WORKS ON RIVERS AND HARBORS FOR NAVIGATION, FLOOD CONTROL, AND OTHER PURPOSES.
For primary bibliographic entry see Field 06E.
W74-03396

FLOOD PLAIN STUDY AND MODEL FLOOD PLAIN ORDINANCE (FINAL ENVIRONMEN-TAL IMPACT STATEMENT).

For primary bibliographic entry see Field 06F. W74-03397

BANKLICK CREEK WATERSHED (FINAL EN-VIRONMENTAL IMPACT STATEMENT).
Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 04D. W74-03398

RECREATIONAL DEMAND AT LAKES AND

RESERVOIRS, Eno Foundation for Transportation, Inc. Saugatuck, Conn. For primary bibliographic entry see Field 06D.

W74-03480

THE EFFECTS OF WATER CONSERVATION WORKS ON THE REGIME OF MORECAMBE

Hydraulics Research Station, Wallingford, (England). F. J. T. Kestner.

The Geographical Journal, Vol 138, No 2, p 178-208, 1972. 18 fig, 7 plates, 6 ref.

Descriptors: \*Tidal effects, \*Feasibility studies, \*Water conservation, \*Water works, Model stu-dies, Costs, Water resources development, Hydraulic structures, Water storage, Ocean currents, Estuaries, Harbors, Erosion, Bays, Reservoirs, Bottom sediments.

Identifiers: \*Morecambe Bay (England), \*Bar-

The feasibility of using Morecambe Bay for water conservation was studied from January 1967 through the summer of 1971. Various engineering, economic, ecologic and social aspects involved in this large storage scheme were studied. The effects of these water conservation works in Morecambe Bay on tides, currents and the regime of sand in the areas seaward of the proposed works were investigated. Field work was carried out in the Bay and a large tidal model was constructed at Wallingford. The research indicated that a pumped storage scheme, consisting of reservoirs on Cartmel Warf and on the foreshore at Silverdale would not interfere with the regime of Morecambe Bay while a full, shore to shore barrage, and also a lesser scheme consisting of separate barrages further landward across the estuaries of the Kent and Leven rivers, would cause serious accretion at Morecambe and in Heysham Lake. Included is a discussion of the feasibility study by a panel of professors and en-gineers. (Slattery-Wisconsin) W74-03483

FLOODPLAIN LANDS FOR PARKS AND RECREATION: A CASE STUDY OF MILWAU-

Wisconsin Univ., Madison. For primary bibliographic entry see Field 06B. W74-03491

UPPER EEL RIVER DEVELOPMENT. IN-VESTIGATION OF ALTERNATIVE CON-VEYANCE ROUTES, California State Dept. of Water Resources, Sacramento.

For primary bibliographic entry see Field 06B. W74-03503

TECHNIQUES IN FORECASTING CONTENT OF ORGANIC AND BIOGENIC SUBSTANCES IN WATER OF EXISTING AND PROPOSED WATER BODIES (K METODIKE PROG-NOZIROVANIYA SODERZHANIYA OR-GANICHESKIKH BIOGENNYKH VESHCHESTV V VODE SUSHCHEST-VUYUSHCHIKH I PROYEKTIR UYEMYKH VUYUSINGALIAN VODOYEMOV), Abademiya Nauk URSR, Kiev. Instytut Akademiya Hidrobiologii

For primary bibliographic entry see Field 02H. W74-03535

MASS DEVELOPMENT OF HYDRURUS IN THE YENISEI BELOW THE KRASNOYARSK RESERVOIR DAM, (IN RUSSIAN), Akademiya Nauk SSSR, Novosibirsk.
A. E. Kuz'mina.

Izv Sib Otd Akad Nauk SSSR Ser Biol Med Nauk.

1 p 54-56, 1972. (English summary). Identifiers: Dams, Electric power, Hydro-electric power plants, \*Hydrurus-Foetidus, Reservoirs, USSR (Yenisei River).

Investigations were conducted in the Yenisei river (USSR) below the Krasnoyarsk hydro-electric power station with purpose of ascertaining why the Krasnoyarsk water intakes are hindered. The appearance and mass development of H. foetidus in view of the change of hydrological regime of the examined part of the river appears to be the main cause of malfunction.—Copyright 1973, Biological Abstracts Lec. Abstracts, Inc. W74-03550

THE GREAT MIAMI RIVER CORRIDOR STU-DY: A CONCEPT PLAN.
Kiley (Dan) and Partners, Charlotte, Vt.
For primary bibliographic entry see Field 06F. W74-03631

CONTROL OF AQUATIC PLANT LIFE, Pennwalt Corp., Philadelphia, Pa. (Assignee)

H. L. Lindaberry.
U.S. Patent No. 3,765,863, 5 p, 3 ref; Official Gazette of the United States Patent Office, Vol 915, No 3, p 986, October 16, 1973.

\*Patents, Descriptors: \*Algicides, Euthrophication, \*Aquatic weed control, \*Aquatic fungi, Aquatic plants, Aquatic algae, Water pollu-Identifiers: Amine oxides.

Improved means are needed to effectively control the many varieties of undesirable weeds, fungi, and algae existing in ponds, lakes, or streams without harming desirable life forms. Certain amine oxide salts are used to chemically control unwanted aquatic plant life. Six examples are cited. Since the amine oxide salt is water soluble, it will diffuse out from the area treated. The preparation of the amine oxide salts of the 3,6-endoxohydrophthalic acids is readily carried out, without need of critical controls, simply by contacting the desired amine oxide with a stoichiometric amount of the desired 3,6-endoxohydrophthalic acid or anhydride. The temperature for the reaction will usually be between about 30 deg and 90 deg C. and the process is completed in a short time. Both the mono- and di-tertiary amine oxide salts of the acid may be prepared and used. To prepare the mono-salt the stoichiometric amount of amine oxide used will simply be one-half that

### WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

Groundwater Management—Group 4B

required for the dibasic salt. All of the 3,6-endoxohydrophthalic acids and anhydrides may be used to form salts with the tertiary amine oxides. (Sin-W74-03653

WATER CONTROL APPARATUS RESPONSIVE TO LEAKAGE OR OVERFLOW CONDITIONS,

U.S. Patent No. 3,766,936, 4 p, 7 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 915, No 4, p 1265, October 23, 1973.

Descriptors: \*Patents, \*Leakage, \*Overflow, Buildings, Water supply, \*Water conservation, Equipment, \*Domestic water, \*Drainage.

Overflow water is received from any of a combination of areas in a building structure through a system of collection tubes. Water collected by the tubes is directed into a vessel which is pivotably supported by a shaft having electrical contacts fixed to one end. In a normal inoperative position, the vessel extends horizontally over the axis of the shaft. Counterweights, fixed to the vessel, extend from the other side of the axis to maintain the horizontal position of the vessel. The weight of water draining from the tubes into the vessel, however, upsets this balance and causes the vessel to downwardly. This movement rotates the shaft, bringing the contacts into engagement with a pair of electrical connectors. This contact pair of electrical connectors. This contact completes a circuit, operating a solenoid to close a gate valve in the main water supply. A second cir-cuit is then completed by the moving contacts to activate an indicator located on a control panel. The water supply will remain closed until an attendant manually activates solenoids to reset the water control device and reopen the main water supply. Water drained through the collection tubes and the water control device during overflow is directed to the building's drainage system. (Sinha -W74-03663

CONTROLLING ALGAE WITH 5- (5 BARBITU-

CONTROLLING ALGAE WITH 5- (5 BARBITU-RILIDENE)-RHODANINE, Gates Rubber Co., Denver, Colo. (assignee). A. F. Kerst, J. D. Douros, Jr., and M. Brokl. U.S. Patent No 3,765,864, 4 p. Official Gazette of the United States Patent Office, Vol 915, No 3, p 986, October 16, 1973

Descriptors: \*Patents, \*Algae, Water treatment, Water supplies, Eutrophication, \*Algicides, \*Aquatic weed control, \*Algal control, Aquatic algae, Aquatic plants, Water pollution control. Identifiers: \*Rhodanine compounds, Anabaena, Synura, Chlorella, Oscillatoria, Lyngbya, Chlamydomonas, Ankistrodesmus, Scenedesmus

The presence of algae in water can result in such deleterious effects as rampant plant growth, health hazards, discoloration, bad taste and odor as well as blockage of pipes, filters, tanks and similar equipment. 5- (5'-barbiturilidene)-rhodanine compounds can be used to inhibit the growth of a wide variety of algae species which cause these problems in water supplies. For example 5- (5'-barbiturilidene)-rhodanine compounds may be emploved against: (1) taste and odor causing algae such as Anabaena and Synura; (2) filter clogging algae such as Chlorella, Oscillatoria, and Anabaena; (3) polluted water algae such as Lyngbya, Chlamydomonas, Anabaena and Oscillatoria; (4) clean water algae such as Ankistrodesmus and (5) surface water algae such as Scenedesmus. (Sinha - OEIS) W74-03665

PUBLIC WORKS FOR WATER AND POWER DEVELOPMENT AND ATOMIC ENERGY COMMISSION APPROPRIATION BILL, 1974, PARTS 1 AND 2.

For primary bibliographic entry see Field 06E.

W74-03710

TROPICAL BAY IN DANGER, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla. For primary bibliographic entry see Field 06G. W74-03716

THE RIVER OF GRASS IS DRYING UP. For primary bibliographic entry see Field 06G.

THE IMPERILED EVERGLADES, For primary bibliographic entry see Field 06G. W74-03720

THE WATER CYCLE ON A WATERSHED IN THE PALOUSE REGION OF IDAHO. Bureau of Reclamation, Fresno, Calif.

D. J. Davis, and M. Molnau. Transactions of the ASAE (American Society of Agricultural Engineers) Vol 16, No 3, p 587-589, 1973, 3 fig, 3 tab, 5 ref. OWRR A-029-IDA (2).

Descriptors: \*Hydrologic cycle, \*Idaho, \*Watershed management, \*Hydrologic data,

\*Water distribution (Applied), Evapotranspira tion, Precipitation (Atmospheric), Surface runoff, \*Water balance.

Distribution of water in the hydrologic cycle within the Palouse region of Idaho is becoming a concern of the people in the region. A few investigations have been made to determine the distribution of water, but most of these have resulted in only very rough estimates. During the 1969-70 water-year an approximate water balance fo a small agricultural watershed showed 25 in. of total precipitation was distributed 20% to runoff, 64% to evapotranspiration, and 16% to deep percolation. Some of the data used in this water balance were estimated or transposed rather than directly measured at the watershed. During the 1970-71 water-year improved instrumentation and procedures provided a better water balance. It was found that 27.5 in. of total precipitation was distributed 23% to surface runoff, 56% to evapotrans-piration, 181/2% to deep percolation and 21/2% to an increase in soil moisture. All of these 1970-71 values are based on data collected at the watershed. W74-03739

### 4B. Groundwater Management

INTEGRATED SYSTEM IDENTIFICATION AND OPTIMIZATION FOR CONJUNCTIVE USE OF GROUND AND SURFACE WATER PHASE I.

Case Western Reserve Univ., Cleveland, Ohio. Systems Engineering Div.
For primary bibliographic entry see Field 02F. W74-03201

UNDERGROUND WASTE MANAGEMENT AND ARTIFICIAL RECHARGE, VOLUMES 1 AND 2. American Association of Petroleum Geologists, Inc., Tulsa, Okla.

For primary bibliographic entry see Field 05E. W74-03222

SALINE AOUIFERS--FUTURE STORAGE RESERVOIRS FOR FRESH WATER, Louisiana State Univ., Baton Rouge. Dept. of

Petroleum Engineering. For primary bibliographic entry see Field 05E. W74-03224

ARTIFICIAL RECHARGE IN UNITED KING-DOM WITH SPECIAL REFERENCE TO LON-DON BASIN.

Water Resources Board, Reading (England).
R. L. H. Satchell, and W. B. Wilkinson.
In: Underground Waste Management and Artificial Recharge, Vol 1, p 34-59, 1973. 10 fig, 2 tab, 8

Descriptors: \*Artificial recharge, \*Hydrogeology, \*Groundwater basins, Mathematical models, Analog models, \*Simulation analysis. Identifiers: \*London, England.

In England and Wales, about one-third of all public water supplies are taken from natural groundwater. In many places groundwater levels have been lowered extensively, causing saline intrusion and other problems. A hydrogeologic study was carried out to assess the potential for recharge beneath London. Over the last 170 years, groundwater levels have fallen, in some areas more than 250 ft, creating a storage volume exceeding 200 bil-lion gal-about 5 times the total surface storage available in the Thames basin. An electric analog was constructed to assist in proving the transmis-sivity and storativity maps calculated from pump-ing test data obtained during the last 100 years. An engineering and economic investigation used 2 main techniques: (1) digital groundwater models of the selected recharge areas, and (2) a digital simulation, using 84 years of records of daily flows in the Thames. Additional yields of more than 70 mgd could be made available at low cost without the need of further surface storage. Field experiments involve the recharge of an existing Chalk well and adit system; in the other, water was injected into a a pair of new wells, one open only to the Chalk and one open only to the Thanet Sands. (See also W74-03222) (Knapp-USGS) W74-03225

UNDERGROUND WASTE DISPOSAL AND AR-TIFICIAL RECHARGE IN JAPAN,

Tokyo Univ. of Education (Japan). Faculty of Science. For primary bibliographic entry see Field 05E. W74-03226

SUBSURFACE DISPOSAL OF LIQUID INDUS-

TRIAL WASTES IN ALABAMA-A CURRENT STATUS REPORT, Geological Survey, University, Ala. For primary bibliographic entry see Field 05E. W74-03227

EFFECTS OF WASTE PERCOLATION OF GROUNDWATER IN ALLUVIUM NEAR BARSTOW, CALIFORNIA, Geological Survey, Garden Grove, Calif. For primary bibliographic entry see Field 05E. W74-03228

ROLE OF BOREHOLE GEOPHYSICS IN UN-DERGROUND WASTE STORAGE AND ARTIFI-

CIAL RECHARGE, Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05E. W74-03229

FEASIBILITY STUDY OF A SEISMIC REFLEC-TION MONITORING SYSTEM FOR UN-DERGROUND WASTE-MATERIAL INJECTION

For primary bibliographic entry see Field 05B.

W74-03230

HYDRAULIC FRACTURING AS A TOOL FOR DISPOSAL OF WASTES IN SHALE, Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05E.

# Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

# Group 4B—Groundwater Management

W74-03231

SHORT-TERM EFFECT OF INJECTION OF TERTIARY-TREATED SEWAGE ON IRON CONCENTRATION OF WATER IN MAGOTHY AQUIFER, BAY PARK, NEW YORK, Geological Survey, Mineola, N.Y. For primary bibliographic entry see Field 05C. W74-03232

RADIOACTIVE- AND CHEMICAL-WASTE TRANSPORT IN GROUNDWATER AT NATIONAL REACTOR TESTING STATION, 10AHO: 20-YEAR CASE HISTORY AND

DIGITAL MODEL,
Geological Survey, Idaho Falls, Idaho.
For primary bibliographic entry see Field 05B. W74-03233

MODIFICATION OF ARTIFICIALLY RECHARGED WATER IN SWITZERLAND, For primary bibliographic entry see Field 05B. W74-03234

HYDRODYNAMICS OF MOUNT SIMON SAND-STONE, OHIO AND ADJOINING AREAS, Geological Survey, Columbus, Ohio. For primary bibliographic entry see Field 05B. W74-03235

DEDUCTION OF FLOW PATTERNS IN VARIA-BLE-DENSITY AQUIFERS FROM PRESSURE AND WATER-LEVEL OBSERVATIONS, Illinois State Geological Survey, Urbana.

D. C. Bond.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 357-378, 1973. 4 fig, 10 ref.

Descriptors: \*Groundwater movement, \*Water Beschptors: Ordunawater movement, Water levels, \*Interfaces, \*Hydrogeology, Aquifer characteristics, Gravity, Oil-water interfaces, Saline water-freshwater interfaces.

In previous potentiometric studies of variable-denin previous potentiometric studies of variable-den-sity aquifers, gravitational effects include the ef-fects of troughs formed by permeability barriers within the aquifers and the effects of structural troughs, saddles, anticlines, and synclines. In intermontane regions these gravitational effects probably are negligible in comparison with observed head differences; in most other regions they can appreciably change the heads that are available to cause flow. A gradient in potential is not necessarily associated with flow, even though corrections are made for the average rate of change in density of water. Gravitational effects can cause the interface between water and an oil or gas deposit to be tilted, even if the water under the deposit is static. These effects can reduce the rate of flushing of brine by freshwater, or they can prevent flushing. (See also W74-03222) (Knapp-HEGE) W74-03236

UNDERGROUND STORAGE AND RETRIEVAL OF FRESH WATER FROM A BRACKISH-OF FRESH WATER FROM A BRACKISH--WATER AQUIFER, Geological Survey, Norfolk, Va. D. L. Brown, and W. D. Silvey. In: Underground Waste Management and Artifi-

cial Recharge, Vol 1, p 379-419. 1973. 12 fig, 5 tab,

Descriptors: \*Artificial recharge, \*Water storage, \*Water chemistry, \*Hydrogeology, Injection wells, \*Virginia, Aquifer characteristics, Clay minerals, Ion exchange, Permeability, Specific capacity, Brackish water. Identifiers: Norfolk (Va).

A study of injection of freshwater into a confined aquifer containing brackish water was undertaken to determine whether the host formation would accept large volumes of freshwater, to determine the degree of mixing of fresh and saline water, and to determine the percentage of recoverable fresh-water after long periods of storage. In tests, fresh-water was injected at a rate of 400 gpm. The specific capacity of the well decreased in one test from an initial value of 15.4 gpm/ft of drawdown to 9.3 gpm/ft after 260 minutes of injection. The other tests had similar results. The reduction in flow rate and specific capacity was due to a uniform reduction in permeability throughout the aquifer. Loss of specific capacity was due to clay dispersion. Chemical data indicated that the sodium-rich clays were involved in cation exchange. During injection, calcium and magnesium replaced sodium on the clays. During withdrawal, this reaction was reversed. The net effect of the cation exchange was to decrease very slightly the tendency of the clays to disperse during injection. Chemical treat-ment was tested to decrease or eliminate clay dispersion. A preflush of 3,000 gal of 0.2 normal calcium chloride was injected before the fresh-water. A maximum injection rate could be maintained by injecting for periods of 1,200 and 1,400 minutes, then withdrawing water for 30 minutes to clear the injection zones. A total of 20 million gal of freshwater was injected. The water was left the aquifer for about 8 weeks before beginning the withdrawal phase. About 85% of the injection water could be recovered. (See also W74-03222) (Knapp-USGS) W74-03237

RETENTION OF DISSOLVED CONSTITUENTS OF WASTE BY GEOLOGIC MEMBRANES, Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 05B. W74-03238

HYDROGEOLOGIC STUDIES AT A SUBSUR-FACE RADIOACTIVE-WASTE-MANAGEMENT SITE IN WEST-CENTRAL CANADA, Waterloo Univ. (Ontario). Dept. of Earth

For primary bibliographic entry see Field 05E. W74-03239

MOVEMENT AND ACCUMULATION OF SUSPENDED SEDIMENT DURING BASIN RECHARGE.

Southwestern Great Plains Research Center, Bushland, Tex.

D. W. Goss, and O. R. Jones.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 468-478, 1973. 5 fig, 2 tab,

Descriptors: \*Artificial recharge, \*Sedimentation, \*Pit recharge, Turbidity, Permeability, Infiltra-tion, Recharge ponds, Silting, Water spreading.

The movement and accumulation of sediment suspended in water used for recharge were determined by microscopic examination of thin sections from material underlying a recharge basin. The basin had been infiltrated to the depth of 91 m by water averaging 191 ppm suspended sediment in six recharge cycles. Flakelike structures were found on the upper 2.5 cm. Two horizontal sheetlike structures, 0.1 mm thick, were found between the depths of 5-8 and 8-12 cm. Fillings in voids, mostly between 2.5 and 23 cm were filled. The average pore volume lost between the depths of 2.5 and 5 cm was 1.5%, and, below 5 cm, less than Porosity was maintained by freezing and thawing and by wetting and drying. Infiltration rates of the basin have not been noticeably reduced. The successful use of excavated basins for recharge of turbid water should not be limited by the movement and accumulation of suspended sediment in the basin material. (See also W74-03222) (Knapp-USGS) W74-03240

GEOHYDROLOGY OF BURIED TRIASSIC BASIN AT SAVANNAH RIVER PLANT, SOUTH CAROLINA, Du Pont De Nemours (E.I.) and Co., Aiken, S.C.

Savannah River Lab. For primary bibliographic entry see Field 05E. W74-03241

ARTIFICIAL RECHARGE OF TREATED WASTE WATERS AND RAINFALL RUNOFF INTO DEEP SALINE AQUIFERS OF PENINSU-LA OF FLORIDA,

Black, Crow and Eidsness, Inc., Gainesville, Fla. For primary bibliographic entry see Field 05E. W74-03242

INJECTION OF ACIDIC INDUSTRIAL WASTE INOT A SALINE CARBONATE AQUIFER: GEOCHEMICAL ASPECTS. Geological Survey, Tallahassee, Fla. For primary bibliographic entry see Field 05E. 74-03243

HYDROLOGIC EVALUATION OF INDUSTRI-AL-WASTE INJECTION AT MULBERRY. FLORIDA,

Geological Survey, Tampa, Fla. For primary bibliographic entry see Field 05E. W74-03244

CASE HISTORY OF SUBSURFACE WASTE IN-JECTION OF AN INDUSTRIAL ORGANIC

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05E. W74-03245

ROLE OF BACTERIA IN DECOMPOSITION OF INJECTED LIQUID WASTE AT WILMINGTON.

North Carolina State Univ., Raleigh. Dept. of Microbiology. For primary W74-03246 bibliographic entry see Field 05B.

HISTORY OF A TWO-WELL INDUSTRIAL--WASTE DISPOSAL SYSTEM, Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center. For primary bibliographic entry see Field 05E. W74-03247

SUBSURFACE DISPOSAL OF WASTE IN KAN-

Kansas State Dept. of Health, Topeka. For primary bibliographic entry see Field 05E. W74-03248

SITE INVESTIGATIONS FOR A BEDDED-SALT PILOT PLANT IN PERMIAN BASIN, Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05E. W74-03249

DEEP-WELL INJECTION OF DESALTING-PLANT WASTE BRINE, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 05E. W74-03250

GEOCHEMICAL HYDROLOGY OF THE BATON ROUGE AQUIFERS,

Louisiana State Univ., Baton Rouge. School of

Seostenice.
R. A. Khan, R. E. Ferrell, Jr., and G. K. Billings.
Available from the National Technical Informa-tion Service as PB-227 087, \$3.25 in paper copy,
\$1.45 in microfiche. Louisiana Water Resources

# WATER QUANTITY MANAGEMENT AND CONTROL—Field 04

# Groundwater Management—Group 4B

Research Institute, Baton Rouge, Bulletin 8, 1972. 63 p, 14 fig, 5 tab, 48 ref. OWRR A-010-LA (2).

Descriptors: \*Groundwater, \*Geochemistry, \*Physicochemical properties, \*Ion exchange, \*Bicarbonate, \*Chlorides, \*Sodium, Hydrogeology, Ion transport, Diagenesis, Groundwater barriers, Regression analysis, Correlation analysis, Permselective membranes, Magnesium, \*Potassium, Water softening, Natural recharge, Mixing, Solvate, \*Louisiana.

Identifiers: \*Baton Rouge (La), Hydrochemical facies, Hydrochemical mapping.

Regression analyses of dissolved chemical content in fresh water from the Baton Rouge aquifers show that the sodium, calcium, and magnesium abundances are functions of the distance from the area of intensive industrial withdrawals and the depth of the well screen. However, a new way of describing the hydrochemical facies gives a better indication of dynamic conditions. For each samples, the cations and anions that constitute 5 percent or more of the total epm value were listed in order of decreasing abundance and the water is classified on this basis. Apparently, the Baton Rouge fault is the only geologic structural feature with any influence on the distribution of the hydrochemical facies. Primary recharge of the aquifers occurs through infiltration of Mississippi River water, with possible slight mixing of water from the Amite and Comite Rivers. Under the industrial area, selective membrane filtration through the deep, compacting clay aquitards, along with ion exchange in the aquifers, has brought about sodium and carbonate enrichment. The offtake of ground water has accelerated the process. In the shallow aquifers, carbonate enrichment has resulted from the solution of calcite and dolomite. The high chloride content of some aquifers apparently stems from dilution of connate W74-03335

EFFECT OF FORMATION DIP ON THE MOVE-MENT OF FRESH WATER STORED IN SALINE AOUIFERS.

Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.

O K Kimbler

Available from the National Technical Information Service as PB-226 946, \$3.00 in paper copy, \$1.45 in microfiche. Completion Report, April 5, 1972. 7 p, 1 fig, 4 ref. OWRR A-011-LA (2). 14-31-0001-3218

Descriptors: \*Injection wells, \*Natural \*Storage capacity, \*Hydrofracturing, \*Aquifers, Model studies, Mathematical studies, Secondary recovery (Oil), Oil reservoirs, Aquifer characteristics, Pores.

Identifiers: \*Saline aquifers.

A fluid flow model was used to investigate the importance of viscous fingering in a radial system. Viscous fingering at unfavorable viscosity ratios (low viscosity fluid displacing higher viscosity fluid) led to extreme irregularities in the displacement front. It was postulated that the study would indicate the effect which gross aquifer in-homogeneities might have on the recovery efficiency during the storage process. A series of displacements in which the low viscosity fluid was injected to a given radius and then produced lack through the same well showed that extreme irregularities of the front developed during injection but irregularities were essentially erased during the production half-cycle. It was found that the 'finger' growth was retarded by large mixed zones. The 'fingers' were erased during the production half-cycle in almost exactly the reverse of the manner in which they formed during injection. Thus, they would have little effect on recovery efficiency in a water storage project. This conclusion is based on the assumption that the fingers are sufficiently broad that transverse dispersion is of little consequence. If the assumption is valid that viscous fingering may, as a first approximation, be used as an analog to frontal irregularity resulting from aquifer heterogeneity, the results suggest that certain types of heterogeneity may not adversely affect recovery efficiency.

VERIFICATION OF CROUNDWATER CAPITAL COSTS

New Hampshire Univ., Durham. Water Resources Research Center. R. H. Forste.

Available from the National Technical Information Service as PB-226 982, \$3.00 in paper copy, \$1.45 in microfiche. Technical Working Paper No. 2, March 1973. 15 p, 2 tab, 5 ref. OWRR A-028-NH (2). 14-31-0001-3529.

Aquifers, Descriptors: \*Groundwater, Descriptors: "Adulters, Adulters, Economics, Least Squares Method, Coastal Plains, Rocks, "Capital costs, "Operating costs, Model studies, Water wells, Regression analysis, Groundwater mining, Glacial sediments.

Identifiers: "Multiple Well Systems, Capital cost models, Capabilidate seeks." models, Consolidated rocks.

The objective of this study was to determine if a model could be specified that would be of use to planners when installing or expanding wellfields to provide additional water. Wells and associated equipment vary in terms of cost and complexity, depending upon capacity and depth of the well. Both capital costs and operating cost components are of importance. Since these cost factors vary as to location and since geological formations will affect capital costs, cost data as a guide to planning a water supply system are not readily available. A model was developed, dealing only with the capital costs of well installation. Parameters of the model were estimated by least squares. Although the model yielded an extremely high coefficient of multiple determination, the predictive value of the model was rebutted. This rejection indicates that some important variables were omitted. Several methods of specifying these omissions were suggested. In terms of policy and/or planning, the model has not been adequately tested to determine its predictive value. W74-03338

PROPOSED MUNICIPAL WASTE WATER--GROUNDWATER EXCHANGE, CITY OF TUCSON: AVRA-MARANA VALLEY. Arizona Water Resources Research Center, Tuc-

son; and Arizona Agricultural Experiment Station, Tucson.

For primary bibliographic entry see Field 05G. W74-03340

ARTIFICIAL RECHARGE-STATE OF THE

ART,
Geological Survey, Lubbock, Tex.
R. F. Brown, and D. C. Signor.
In: Underground Waste Management and Artificial Recharge Vol 2, p 668-686, 1973. 48 ref.

Descriptors: \*Artificial recharge, \*Waste disposal wells, \*Reviews, Water spreading, Indection wells, Underground waste disposal, Induced infil-tration, Mathematical models, Pit recharge, Recharge ponds.

The largest potential reservoir for the storage of potable water is in the unsaturated zone. Artificial recharge has many similarities to liquid-waste disposal through deep wells. In both, the problem is to place liquid in a permeable lithologic unit at an economic rate, to predict movement and the chemical reactions and physical changes that take place while the liquid is in the reservoir. Water commonly is recharged by surface spreading through basins or by induced recharge from ad-jacent streams and lakes or through injection wells. Research in recharge through basins has been dominated by mathematical models based on idealized conditions and empirical relations, derived by experimental sequencing of recharge operations, and operational controls in the pretreatment of recharge water. Recharge by injection wells has been undertaken in a variety of hydrologic environments. In Israel efforts have been directed toward the analyses of diffusion and dispersion of the injected water. Much research in the United States has been directed toward the movement of bacteria and organic matter through an aquifer and toward the chemical modeling of changes in recharged water as it moves. Inter-disciplinary teams should consider the geologic, hydraulic, geochemical, bacteriologic, engineering, geophysical, and economic aspects of the system. (See also W74-03222) (Knapp-USGS) W74-03354

INDUSTRIAL WASTEWATER-INJECTION WELLS IN UNITED STATES-STATUS OF USE AND REGULATION, 1973, Missouri Univ., Rolla. Dept. of Geological En-

gineering.

For primary bibliographic entry see Field 05E. W74-03355

ARTIFICIAL RECHARGE OF COASTAL-PLAIN AQUIFER IN ISRAEL,

Tahal Consulting Engineers Ltd., Tel Aviv (Israel). Div. of Hydrology.

A. Sellinger, and S. H. Aberbach.

In: Underground Waste Management and Artifi-

cial Recharge, Vol 2, p 701-714, 1973.

Descriptors: \*Artificial recharge, \*Injection wells, \*Water spreading, Pit recharge, Water wells, Hydrogeology, Aquifer characteristics, Water

Identifiers: \*Israel, Well clogging, Well develop-

The coastal-plain aquifer is one of the main groundwater sources in Israel. At present it is recharged through 100 wells and 7 spreading grounds with a total area of 265 acres. The average yearly rate of recharge is about 80 million cu m per year. Recharge is practiced mostly during winter months, November through March, and times also during April and October. The main source is Lake Kinneret, supplying 68% of the recharged water; about 17% is storm runoff and 15% is groundwater withdrawn from a limestone aquifer. A decrease in well recharge rates is observed when single-purpose wells (unequipped wells drilled for recharge only) are recharged with Lake Kinneret water. Redevelopment of these wells over a short period does not restore the original recharge rates. The same Lake Kinneret water, when recharged into dual-purpose wells causes only a small decrease in the recharge rate. In the dual-purpose wells, the first batch of water pumped after recharge is contaminated. This contamination (odor, turbidity, and high counts of coliform bacteria) probably is due to the high con-tent of organic matter in the recharged water. To assist in restoring infiltration recharge rates, basins are dried out after each season, the upper layer of soil and silt removed, and the basin cultivated. This results generally in restoration of the infiltration rates to their original values. (See also W74-03222) (Knapp-USGS) W74-03356

HAZARDS OF WASTE DISPOSAL IN GROUND-WATER BASINS,

Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 05E. W74-03357

ASSE SALT MINE, FEDERAL REPUBLIC OF GERMANY--OPERATING FACILITY FOR UN-

# Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

# Group 4B-Groundwater Management

DERGROUND DISPOSAL OF RADIOACTIVE

WASTES, Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg bei Munich West Germany. Institut fuer Stratigraphie. For primary bibliographic entry see Field 05E.

W74-03358

DAN REGION, ISRAEL, SEWAGE-RECLAM-ATION AND RECHARGE PROJECT, Tahal Consulting Engineers Ltd., Tel Aviv

(Israel). Div. of Hydrology. For primary bibliographic entry see Field 05D. W74-03359

LABORATORY FACILITY FOR STUDIES RE-LATED TO ARTIFICIAL RECHARGE, Geological Survey, Lubbock, Tex.

D. C. Signo

In: Underground Waste Management and Artificial Recharge, Vol 2, p 799-822, 1973. 13 fig, 1 tab, 29 ref, append.

Descriptors: \*Artificial recharge, \*Laboratory tests, Infiltration, Percolation, Groundwater movement, \*Permeability, Water spreading, Injection wells, \*Porous media, Aquifer testing.

Flow can be induced through repacked or field cores under contant flow or constant pressure. A flow-test data-aquisition and computation system provides punched-tape data storage and real-time computation and plotting of intrinsic permeability changes with column depth and time. Water-quality data are recorded during the test, and characteristics of the porous media and suspended solids are determined. Accumulation of material in porous-media interstices is observed visually with a scanning electron microscope. A U. S. Geological Survey laboratory facility at Lubbock, Texas, was designed and equipped to provide a means of testing flow through porous-media columns. Artificial groundwater recharge is subject to limitations caused by mechanisms which degrade the hydraulic conductivity of the porous media. Reduction of hydraulic conductivity may be caused by suspended solids, bacterial growth, chemical reaction of dissolved solids with the porous media or native water, and air entrainment or dissolution of gases in the interstices of the porous medium. (See also W74-03222) (Knapp-USGS) W74-03360

HYDROGEOLOGY OF SUBSURFACE LIQUID--WASTE STORAGE IN FLORIDA, Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 05E.
W74-03361

FEASIBILITY STUDY OF LIQUID-WASTE IN-JECTION INTO AQUIFERS CONTAINING SALT WATER, WILMINGTON, NORTH CAROLINA,

North Carolina Dept. of Natural and Economic Resources, Wilmington. Office of Water and Air Resources.

For primary bibliographic entry see Field 05E. W74-03362

USE OF FINITE-DIFFERENCE ARRAYS OF OBSERVATION WELLS TO ESTIMATE EVAPOTRANSPIRATION FROM GROUND WATER IN THE ARKANSAS RIVER VALLEY, COLORADO.

Geological Survey, Washington, D.C. For primary bibliographic entry see Field 02D. W74-03508 RENOVATING SEWAGE EFFLUENT BY GROUND WATER RECHARGE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

For primary bibliographic entry see Field 05D. W74-03520

ENGINEERING DESIGN CRITERIA FOR SPRAY IRRIGATION,
Bishop (William), Tallahassee, Fla.

Bishop (William), Tallahassee, Fla. For primary bibliographic entry see Field 05D. W74-03521

WATER STUDY, SANTA FE PLANNING AREA. Santa Fe City Planning Dept., N. Mex.

January, 1972. 59 p, 10 fig, 1 tab.

Descriptors: \*Water supply, \*Water demand, \*Groundwater, \*Municipal water, Water resources, Environmental effects, Costs, Urban land use, Groundwater availability, Groundwater mining, Groundwater recharge, \*New Mexico, Urbanization, Surface waters, Surface-groundwater relationships, Pumping, Wells, Supply, Rio Grande River.

Identifiers: Future growth, \*Urban growth, Utility extension, Santa Fe (N. Mex.), Santa Fe River.

There are limiting factors to the continued pumping of local wells at their present rates. This points to greater reliance upon water imported from the Rio Grande and the proposed Buckman wells, for the future growth and orderly development of Santa Fe whose projected water use by the year 2000 could reach an estimated 25,200 acre feet per year, outstripping available supplies within 15 years. By that time the city must resist pressures to extensively mine the ground water reservoir, extend public water service to far outlying areas, and develop expensive means to provide city water. The present situation suggests that the city and county need to: (a) adopt local regulations and policies controlling additional use of ground water and the expansion of public water service; (b) undertake immediate studies to quantify ground water limitations and find means of securing a water supply at a reasonable cost for the next 20 to 50 years; (c) study the cost and benefits of the city purchasing the water system; (d) purchase permanent water rights from Buckman, and determine production and cost estimates for Buckman well fields; (e) explore the alternative to construc-tion of a filter plant; (f) reduce dependence on ground water use in the Santa Fe well fields; and (g) actively explore ways to find new and im-proved sources of water at a reasonable cost for a 50 year period, in order to demonstrate that continued population growth will not be detrimental to Santa Fe's environment and economy. Means of securing the necessary water supply, the reduction of groundwater depletion, and the preparation of detailed water studies are discussed. (Edwards-North Carolina) W74-03641

2020 PLAN, BOARD OF WATER SUPPLY/CITY AND COUNTY OF HONOLULU.

Honolulu City and County Board of Water Supply, Hawaii.

February, 1971. 77 p, 28 fig, photos, append.

Descriptors: \*Water supply, \*Groundwater mining, \*Groundwater, \*Hawaii, \*Water demand, \*Projections, Planning, Inter-basin transfers. Identifiers: Honolulu (Hawaii), \*Oahu, Caprock.

Water demand for the island of Oahu can be met indefinitely by tapping groundwater sources on the island. Extremely heavy rainfall falls on the higher elevations and percolates rapidly into porous rock to accumulate in underground aquifers. Stored water moves toward the sea, but is trapped by

relatively impermeable sediments, or caprock. The fresh water forms a vast lens floating on heavier saline water. By means of wells and shafts, water may be pumped to the surface for use. Portions of the rainfall are trapped by nearly impervious dikes at higher elevations where it remains until it seeps away by springs or is drained by tunnels. The island's population is projected to rise from 579,000 in 1970 to 1,500,000 in 2020. Daily water consumption will rise from 102 m.g.d. to 253 m.g.d. More wells and shafts will be needed. The island is divided into nine watersheds for which population, water consumption, and new sources have been projected. Projects are marked for completion by either 1985 or 2020. All watersheds have adequate developable water supplies except the city of Honolulu area. Consequently, water will be imported from other parts of the island. A diagram illustrates developable water supplies in 1980 for each watershed, local demand, and water exports. The uncertainties of population projections are noted. Speculations are made as to the feasibility of utilizing desalinzed sea water, surface water, brackish groundwater, and reclaimed wastewater. (Stein-North Carolina) W74-03649

# 4C. Effects on Water of Man's Non-Water Activities

WATERFOWL HABITAT TRENDS IN THE ASPEN PARKLAND OF MANITOBA, W. H. Kiel, Jr., A. S. Hawkins, and N. G. Perret.

Can Wild Serv Rep Ser. 18, p 8-61, 1972. Illus. Identifiers: Aspen, \*Canada (Manitoba), Drainage, Ducks, Fall, Grain, \*Land use, Migration, Parkland, \*Potholes, Trends, \*Waterfowl habitats.

Natural and man-made changes in waterfowl habitat in the 4100 sq mi Minnedosa district of the aspen parkland of Mannitoba, Canada, are described. Following historical review, the study area and methods, the changing nature of habitat and future considerations are discussed. Road building, land clearing and drainage are affecting potholes at an increasing rate. The Minnedosa district has the potential to contribute at least 1 million ducks to the fall migration. The economy of the region is largely dependent on cereal grain production, and the future of the parkland rests with the landowner.—Copyright 1973, Biological Abstracts, Inc.

LOWER WATER TEMPERATURES WITHIN A

STREAMSIDE BUFFER STRIP,
Forest Service (USDA), Asheville, N.C.
Southeastern Forest Experiment Station.
L. W. Swift, Jr., and S. E. Baker.
USDA Forest Service Research Note SE-193,
April 1973. 7 p. 4 fig. 6 ref.

Descriptors: \*Water temperature, \*Trout, \*Clearcutting, \*Riparian plants, \*Riparian waters, \*Lumbering, Temperature, Shrubs, Trees, Water properties, Fish, Streams, Rivers, Freshwater, Freshwater fish, Thermal pollution, Vegetation effects, \*North Carolina.

The removal of streamside vegetation increases the water temperature in mountain streams. Clear-cutting and farming have been found to raise temperatures beyond the tolerance level for trout (68F). Within the timber sale area of a commercial clearcut in the North Carolina mountains, a narrow buffer strip of uncut trees and shrubs was left beside a stream. Although water temperatures within the area may have exceeded 68F, the stream immediately below the sale area was never warmer than 62F. (Brown-IPC)

EFFECTS OF HIGHWAYS ON SURFACE AND SUBSURFACE WATERS, Southeastern Massachusetts Univ., North Dart-

mouth. Dept. of Civil Engineering.

Public Works, Vol 104, No 11, p 71-73, 123-124, November 1973. 2 fig.

Descriptors: \*Highway effects, \*Subsurface waters, \*Surface waters, Runoff, Storm drains, Water resources, Channels, Flood control, Flood plains, Groundwater, Water quality, Recreation, Erosion, Sedimentation, Road construction. Identifiers: Channel relocation.

The construction of highways can create serious environmental problems in surface and subsurface waters. Such problems need to be identified and solutions considered during the design and location stage of highway construction. Several general problem areas are discussed and solutions are offered to either minimize detrimental effects or maximize beneficial effects. The general problem areas considered are: (1) quantity of water, (2) water resources projects, (3) storm drainage systems, (4) channel relocations, (5) flood controls and flood plains, (6) groundwater, (7) water recreation, (8) community utilities, and (9) water quality. (Mortland-Battelle) W74-03607

NATURAL FEATURES ELEMENT OF THE COMPREHENSIVE PLAN: A PLAN FOR AC-TION. DeKalb County Planning Dept., Decatur, Ga.

June, 1973. 16 p, 3 tab, append.

Descriptors: \*Environmental effects, \*Urbanization, \*Planning, \*Gorgia, \*Comprehensive planning, Natural resources, Land use, Soils, Geology, Hydrology, Water Resources. Identifiers: DeKalb County (Ga.), Open space, Interdisciplinary studies, Land use control, Gwinnett County (Ga.), Newton County (Ga.), Rockdale County (Ga.).

Rapid urbanization in DeKalb County is infringing on open space areas and has significant impacts on the natural environment, e.g. changing surface runoff and stream water quality. An approach is outlined for studying the impacts of urbanization, the capability of open areas to withstand these impacts, the best intensity levels of urban development for certain land areas, and the control of the urbanization process. These studies will be interdisciplinary involving planning departments, public works departments, the Soil Conservation Service, the Corps of Engineers, the U.S. Geological Survey, private groups, and consultants. Three basic goals related to protecting the environment are identified. Specific policies and action proposals for each goal are embodied in the out-lined process for analysis: (1) an inventory of pertinent natural resources; (2) a synthesis of the interrelationships among these resources; and (3) an evaluation of the impact on the natural resources when subjected to various land uses and densities of development. Elements to be included in the natural resources inventory are soils, landforms, geology, topography, hydrology, water quality, climatology, vegetation, and wildlife. (Elfers North Carolina) W74-03633

CONSERVATION-OPEN SPACE AMENDMENTS TO THE SPRINGFIELD COM-PREHENSIVE PLAN. Springfield Planning Dept., Mass. For primary bibliographic entry see Field 03D. W74-03634

METROPOLITAN DEVELOPMENT GUIDE: PROTECTION OPEN SPACE-POLICY PLAN, PROGRAM. Metropolitan Council of the Twin Cities Area,

Minn. For primary bibliographic entry see Field 06G. W74-03635

# 4D. Watershed Protection

MISSISSIPPI PROCEEDINGS. WATER RESOURCES CONFERENCE, 1973.
Mississippi State Univ., State College. Water Resources Research Inst. For primary bibliographic entry see Field 05B. W74-03212

SEDIMENT YIELD ESTIMATES BASED ON FLOODWATER MEASUREMENTS AND SAM-Agricultural Research Service, Oxford, Miss.

Sedimentation Lab. For primary bibliographic entry see Field 02J. W74-03214

ENVIRONMENTAL ASPECTS OF WATERSHED PLANNING. Soil Conservation Service, Jackson, Miss. For primary bibliographic entry see Field 06G. W74-03215

MONITORING NUTRIENT LOSSES FROM SMALL WATERSHEDS, Tennessee Valley Authority, Muscle Shoals, Ala. Soils and Fertilizer Research Branch. For primary bibliographic entry see Field 05B. W74-03219

BANKLICK CREEK WATERSHED (FINAL EN-VIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C.

Available from NTIS, U.S. Dep't of Commerce, as EIS-KY-73-0656-F, for \$5.50 paper copy. March 1973, 62 p, 2 map, 1 append.

Descriptors: \*Water pollution effects, \*Environmental effects, Structures, Ecology, Environmental control, Projects, Project planning, Water resources, \*Kentucky, Channel improvement. Identifiers: \*Environmental Impact Statement, Boone and Kenton Counties, Ky.

This plan was prepared under the authority of the watershed protection and flood prevention act. The summary of environmental impacts and adverse environmental effects showed that project measures are estimated to be favorable although the project is expected to adversely affect the environment by interrupting or limiting agriculture, creating potential inconvenience to residents, affecting the ecology of streams in reservoir areas, increasing erosion, and creating problems associated with increased economic activity. Alternatives considered were nonstructural measures. structural measures, multiple purpose structures, channel work, and no action at all. (Daniels-W74-03398

AMERICAN FALLS DAM, UPPER SNAKE RIVER PROJECT, IDAHO. For primary bibliographic entry see Field 06E. W74-03419

# 05. WATER QUALITY MANAGEMENT AND PROTECTION

# 5A. Identification of Pollutants

SENSITIVITY OF VERTEBRATE EMBRYOS TO HEAVY METALS AS A CRITERION OF WATER QUALITY, Kentucky Water Resources Inst., Lexington. For primary bibliographic entry see Field 05C. W74-03206

SOME DATA ON FLUORINE, BROMINE, AND IODINE CONCENTRATIONS IN ATMOSPHERIC PRECIPITATION AT VORONEZH (NEKO-TORYYE DANNYYE O SODERZHANII FTORA, BROMA I IODA V ATMOSFERNYKH OSAD-KAKH G. VORONEZHA), Voronezhskii Lesotekhnicheskii Institut (USSR).

N. G. Barkalova.

In: Formirovaniye khimicheskogo sostava poverkhnostnykh vod i metody ikh analiza: Gidrokhimicheskiey Materialy, Vol 57, p 3-9, 1973. 2 tab, 23 ref.

Descriptors: \*Water chemistry, \*Fluorine. \*Bromine, \*Iodine, \*Precipitation (Atmospheric), Rain, Snow, Frost, Inorganic compounds, Salts, Identifiers: \*USSR (Voronezh), Mineralization.

Fluorine, bromine, and iodine concentrations in atmospheric precipitation and hoarfrost were investigated at Voronezh in central Soviet Russia between March 5, 1969 and March 4, 1970. The chemical composition of atmospheric precipitation is of the calcium- or sodium-bicarbonate type. The chemical composition of hoarfrost waters is of the calcium-or sodium-sulfate type. Total mineralization varies between 8.10 and 53.71 mg/liter. The fluorine concentration in all precipitation samples varies between 0.06 and 0.54 mg/liter. Snow and rainwaters contain an average of 0.20 and 0.14 mg of fluorine/liter, respectively. Main sources of fluorine in precipitation are dust and aerosol particles rising from the earth's surface, and products of winter fuel combustion. Bromine and iodine concentrations in precipitation reach 0.029 and 0.013 mg/liter, respectively, averaging 0.012 mg of bromine/liter and 0.002 mg of iodine/liter. Variations in concentrations of bromine and iodine in snow and rainwaters are small. Fluorine and bromine concentrations in hoarfrost are twice as high as those in snow and rainwaters. Average concentration of fluorine in hoarfrost is 0.36 mg/liter and in snow and rainwaters is 0.16 mg/liter. Average concentration of bromine in hoarfrost is 0.020 mg/liter and in snow and rainwaters is 0.011 mg/liter. No iodine was detected in hoarfrost. Higher concentrations of fluorine and bromine in hoarfrost may be due to the presence of a large city and its highly developed industrial complex. (Josefson-USGS) W74-03251

TRACE ELEMENTS IN BOTTOM SEDIMENTS OF DNIEPER RIVER RESERVOIRS (MIKROELEMENTY V DONNYKH OTLOZ-VODOKHRANILISHCH HENIYAKH Nauk URSR, Kiev. Instytut Akademiya

Hidrobiologii. For primary bibliographic entry see Field 02K. W74-03254

HYDROCHEMICAL DESCRIPTION AND CAL-CIUM-CARBONATE EQUILIBRIUM OF SHU-CARBONATE

# Group 5A-Identification of Pollutants

HIMICHESKAYA KHARAKTERISTIKA I KAR-BONATNO-KAL'TSIYEVOYE RAVNOVESIYE SHUMAKSKIKH UGLEKISLYKH VOD), Irkutskii Gosudarstvennyi Universitet (USSR). For primary bibliographic entry see Field 02K.

BOTTOM MACROFAUNA IN THE GOCZAL-KOWICE DAM RESERVOIR IN THE YEARS 1965-1969, Polish Academy

of Sciences, Pszczyna. Hydrobiological Station.
For primary bibliographic entry see Field 05C.

THE MICROCALORIMETRY OF MICROBIAL GROWTH. J. M. Jones.

Process Biochemistry, Vol 8, No 9, p 19-20, September 1973. 3 fig, 1 ref.

Descriptors: \*Bacteria, \*Monitoring, \*Growth rates, \*Heat, Cultures, Laboratory equipment, rates, \*Heat, Cultures, Labo Growth stages. Identifiers: \*Microcalorimetry.

A flow microcalorimeter has been used to monitor the heat production of bacterial cultures. In the calorimeter, solutions are pumped through colls which are situated in a sandwich of semiconductor thermopiles and a heat sink. Heat transferred across the thermopiles produces a small voltage directly proportional to the heat. Plots of actual and integrated heat output, glucose concentration, acetate concentration, and cell concentration versus time show that thermograms reveal two distinct phases in growth patterns: (1) the exponential growth phase and (2) the phase in which acetate produced in phase 1 is consumed. Therefore, heat output can be used to describe the separate phases of growth processes. Several applications of the technique are suggested such as monitoring of fermentation processes, production of antibiotics, and reactions to antibiotics. (Little-Battelle)

SOME ARCTIC LIMNOLOGY AND THE HIBERNATION OF INVERTEBRATES AND SOME FISHES IN SUB-ZERO TEMPERA-

Riksmuseet. Stockholm Naturhistoriska (Sweden). Section for Invertebrate Zoology. For primary bibliographic entry see Field 02H. W74-03275

AN IN SITU EXAMINATION OF THE GRAZING ACTIVITIES OF NATURAL ZOOPLANKTON COMMUNITIES

Toronto Univ. (Ontario). Dept. of Zoology For primary bibliographic entry see Field 05C. W74-03276

A LIMNOLOGY STUDY OF A HIGH MOUNTAIN LAKE IN MOUNT RAINIER NATIONAL PARK, WASHINGTON STATE; USA, Washington Univ., Seattle. Fisheries Research

Inst. G. L. Larson.

Archiv fur Hydrobiologie, Vol 72, No 1, p 10-48, June 1973. 26 fig, 14 tab, 47 ref.

Descriptors: \*Photoplankton, \*Primary productivity, Benthic fauna, \*Seasonal, \*Zooplankton, Water quality, \*Rotifers, \*Dinoflagellates, Pig-Water quality, \*Rotifers, \*Dinoflagellates, Pigments, Crustaceans, Diatoms, Cyanophyta, Chlorophyta, Protozoa, Water analysis, Biomass, Trophic level, Population, Alkalinity, Hydrogen ion concentration, Dissolved oxygen, Nitrogen, Phosphorus, Color, Dissolved solids, Water temperature, Electrical conductance, Oligochaetes, Diptera, \*Washington, Sampling.

Identifiers: Mowich Lake (Wash.), Macroinvertebrates, Transparency, Eucyclops agilis, Kellicottia longispina, Keratella hiemalis, Keratella cochlearis, Collotheca pelagica, Collotheca libera, Conochilus unicornis, Pisidium, Notholca squa-mata, Polyarthra, Encentrum, Melosira distans, Synedra ulna, Gomphonema olivaceum, Diatoma hiemale. Eunotia robusta.

Mowich Lake, a high mountain lake in the Western Washington State Cascade Mountains, was studied from March to November 1967 to determine biotic relationships. Alkalinity, pH, oxygen, N, P, color, dissolved solids, temperature, transparency, conductance and primary producwere determined. Phytoplankton were collected, enumerated, and extractable pig-ments determined. Zooplankton were collected from 7 depths, counted, and reproductive rates calculated. Macrobenthos was sampled at 5 depths. In general, the lake was low in mineral content and unproductive. The winter lake cover appeared to play an important role in primary production by way of nutrient additions. Primary production, extractable phytoplankton pigments and total phytoplankton biomass were strongly correlated in both time and space, and were maximal in July. The maximum primary production was 152/sq m and 21/cu m mg C assimilated per day. Maximum phytoplankton biomass was 32/sq m and 1.7(cu m gm fresh weight. The activity quo-tient ( (mg C assimilated/sq m/day)/ (mg phytoplankton biomass/sq m)) indicated the pri-mary production of Mowich Lake to be in the oligotrophic range. The zooplankton community consisted of eight species of Rotifera. The only crustacean, Eucyclops agilis, was occasionally taken pelagically, but was usually confined to littoral and benthic regions. Zooplankton populations were maximal between early October and mid-November. The egg ratio reproductive rate, B (eggs/female/day), was maximal from September to early October. Other population coefficients were also calculated for Kellicottia longispina and Keratella hiemalis. The macro-benthos was about intermediate in mean dry weight (1.8 gm/sq m) as compared to other oligotrophic lakes and was dominated by Chironomidae. (Little-Battelle) W74-03277

THE OCCURRENCE OF MICROTURBEL-LARIA IN SOME BRITISH LAKES OF DIVERSE CHEMICAL CONTENT, Liverpool Univ. (England). Dept. of Zoology. For primary bibliographic entry see Field 05C. W74-03282

A CULTURE SYSTEM FOR ARTEMIA, DAPHNIA, AND OTHER INVERTEBRATES, WITH CONTINUOUS SEPARATION OF THE

Ghent Rijksuniversiteit (Belgium).

P. Sorgeloos, and G. Persoone. Archiv fur Hydrobiologie, Vol 72, No 1, p 133-138, June 1973. 1 fig, 9 ref.

Descriptors: \*Cultures, \*Laboratory equipment, \*Waterfleas, \*Automatic control, \*Brine shrimp, Continuous flow, Bioassay, Design, \*Daphnia, In-

Identifiers: Continuous cultures, Artemia salina, Daphnia magna, Macroinvertebrates

AN APPARATUS DEVELOPED FOR CON-TINUOUS CULTURING OF Artemia, Daphnia, and other invertebrates consists of five chambers, four of which have funnel-shaped bottoms, which are connected by tubes and siphons. Chamber A contains the food supply which can be an algal culture and is connected by siphons to chamber E, the water collector, and chamber B, the adult culturing chamber. Chamber B is connected by a tube from the bottom to chamber C, the larvae collecting chamber, which in turn is connected from the side to chamber D, the water supply. To operate

the system, an aquarium pump is switched on by a timer for 5 minutes every half hour to pump water from the water supply (D) to the water collector (E). This activates the siphons connecting the food supply (A) and the culture chamber (B) to bring food and aerated water into chamber B. At the same time the inflow of water carries the larvae from B into the larvae collecting chamber C and the overflow in C goes to the water supply (D). A filter in the culture chamber prevents the transit of adults into the larval chamber. Larvae can be collected by means of a value in the bottom of the collecting chamber. The equipment has been used for 6 months with no special problems. (Little-Bat-W74-03283

STUDIES ON PHYTOPLANKTON IN RELA-TION TO ITS PRODUCTION AND SOME PHYSICAL-CHEMICAL FACTORS IN LAKE

SVINSJOEN, Oslo Univ. (Norway). Dept. of Limnology. For primary bibliographic entry see Field 05C. W74-03284

A NEW METHOD FOR THE ESTIMATION OF ABSOLUTE MICROFOSSIL NUMBERS, WITH REFERENCE ESPECIALLY TO DIATOMS, Uppsala Univ. (Sweden). Dept. of Quaternary

Geology. R. W. Battarbee. Limnology and Oceanography, Vol 18, No 4, p 647-653, July 1973. 3 fig, 4 tab, 14 ref.

Descriptors: \*Diatoms, \*Cytological studies, Statistical methods, Sampling, Sediments, Pa-lynology, Lakes, Data processing, Equations. Identifiers: \*Sample preparation, \*Counting, Evaporation trays, Method validation, Data in-terpretation, Lough Neagh, Ireland.

Random distribution of diatoms for estimation of absolute microfossil numbers can be obtained using an evaporation tray with depressions to hold four cover slips. A measured quantity of well mixed suspension is added to the tray and allowed to evaporate without disturbance. The cover slips can then be removed or the samples mounted directly by inverting a slide with mountant on the cover slips. Statistical analyses of randomness and various showed that the technique is statistically reliable. Procedures are given for utilizing these data on combination with data on water content, sediment density, and deposition rate to produce meaningful results. Data obtained for Lough Neagh, Northern Ireland suggest a relationship between increasing total diatom deposition, increasing importance of alkalibiontic species in fos-sil diatom communities, and the possible progress of eutrophication. (Little-Battelle) W74-03285

THE CONSTRUCTION OF A SAND PROFILE SAMPLER: ITS USE IN THE STUDY OF THE VORTICELLA POPULATIONS AND THE GENERAL INTERSTITIAL MICROFAUNA OF SLOW SAND FILTERS, Surrey Univ., Guilford, (England). Dept. of Biological Sciences.

B. Lloyd. Water Research, Vol 7, No 7, p 963-973, July 1973. 3 fig, 4 tab, 13 ref.

Descriptors: \*Connate water, \*Aquatic microorganisms, \*Fabrication, Protozoa, Rotifers, Annelids, Nematodes, Copepods, Aquatic populations, Methodology, Microscopy, Monitoring, Flow rates, Oligochaetes, Beaches, Filtration, Operation.

Identifiers: Sand profile sampler, equipment, Direct sampling, "Sand filters, Flat-worms, Species abundance, Vorticella spp, Sam-pling techniques, Light microscopy, Tardigrades, Gastrotricha, Turbellaria, Suctorians, Marine en-

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Identification of Pollutants-Group 5A

vironment, Nais, Stylaria fossularis, Aelosoma hemprichii, Vorticella picta, Vorticella campanula, Vorticella convallaria, Vorticella fromenteli, Vorticella communis, Oxytricha, Tachysoma pellionella.

A simple and inexpensive method is described by which the component groups of the interstitial fauna can be examined undisturbed by direct microscopy. The method has been developed specifically to locate and enumerate the functional interstitial microfauna of slow sand filters used in water purification and it is designed to demonstrate the spatial relations of the constituent populations as they develop in time in a flowing system. Details of construction and methods of operating the sampler developed in this study are given. It has the features of (1) simple construction and being composed of cheap materials; (2) no mechanical closure device, thus no jamming; and (3) the depth distribution of living organisms being examined directly and immediately without disturbing the column or subsampling. The sampler has been successfully applied to monitoring the development of Protozoa and Rotifera in pilot scale and full scale slow sand filters at the London Metropolitan Water Board's Walton and Ashford Common Treatment Works. Results are presented for the incidence of the general microfauna and for the development, vertical distribution and effect of flow rate on the Vorticella populations. (Holoman-Battelle) W74-03286

# THE REALITY OF THREE BRITISH BIOTIC INDICES.

INDICES, Vysoka Skola Chemicko-Technologicka, Prague (Czechosłovakia). Dept. of Water Technology. V. Sladecek.

Water Research, Vol 7, No 7, p 995-1002, July 1973. 8 tab, 28 ref.

Descriptors: "Natural streams, "Benthic fauna, "Invertebrates, "Bioindicators, Aquatic insects, Water quality, Annelids, Crustaceans, Mollusks, Growth stages, Nematodes, Caddisflies, Midges, Water beetles, Diptera, Oligochaetes, Stoneflies, Mayflies, Snails, Shrimp, Amphipoda, Isopods, Tubificids, Water pollution, Aquatic animals. Identifiers: "Biotic index, "Saprobic index, Water mites, Species abundance, Macroinvertebrates, Flatworms, Limpets, Water hoglice, Asellus, Alderflies, Chironomids, Leeches, Leuctra, Chironomis thummi, Gammarus, Eristalis tenax, Nais, Planaria alpina, Turbellaria, Ancylus, Rhyacophila, Dicranota, Limnophora, Simulium,

Black flies, Baetis, Nemoura, Amphinemura, Hydracarina, Glossiphonia, Haemopis, Tubifex, Chironomus riparius, Capnia, Linmodrilus, Chloroperla, Isoperla, Perla, Taeniopteryx.

In Great Britain three indices are used for classification of streams according to benthic invertebrates: the Trent River Board Biotic Index (Woodiwiss, 1964), the Lothians River Purification Board Index (Graham, 1965) and the Score-System (Chandler, 1970). All these indices are based in reality on the saprobic system of Kolkwitz and Marsson (1902, 1908, 1909) and its modern developments, mainly the saprobic index by Pantle and Buck (1955) and the saprobic index by Pantle and Buck (1955) and the saprobic relation in the saprobic system of the saprobic system of the saprobic system of the saprobic of the saprobic system of the saprobic of the saprobic index by Pantle and Buck (1955) and the saprobic relation in the saprobic system of the saprobic sy

IDENTIFICATION AND INCIDENCE OF KLEB-SIELLA IN CHLORINATED WATER SUP-PLIES.

Chicago Dept. of Water and Sewers, Ill. Water Purification Div.
D. J. Ptak, W. Ginsburg, and B. F. Willey.

Journal American Water Works Association, Vol 65, No 9, Part 1, p 604-607, September 1973. 1 fig, 5 tab, 14 ref.

Descriptors: \*Pathogenic identification, Cultures, \*Coliforms, Chlorination, Public health, Water analysis, Biochemistry, Disinfection, Bioindicators, Water supply, Water treatment.

Identifiers: IMViC test, Standard methods, R/B procedure, \*Klebsiella, Validation, Fecal coliforms, Surviyal, Errors.

Concern over the standard method of classifying coliforms, caused the Microbiology Unit, Water Purification Lab., City of Chicago, to institute a study to determine whether a more accurate and rapid classification could be obtained. The 'Modified R/B Enteric Differential System' was selected and used to identify the cause of the occasional positive reactions which occurred during water analysis. The bacterium identified was Klebsiella pneumoniae which is known to be of fecal origin. Since the standard IMViC test would have identified Aerobacter aerogenes, generally considered to be of non-fecal origin, an improved laboratory procedure appears to be needed. The modified R/B procedure used by the Water Purification Laboratory and the resulting reactions are described. Klebsiella has also been found to occur more frequently in treated water supplies than other organisms possible because it is encapsulated in the mucoid phase. Therefore, procedures should be employed to avoid incorrect identification of the organisms. (Little-Battelle) W74-03294

# SEDIMENT COLIFORM POPULATIONS AND POST CHLORINATION BEHAVIOR OF WASTEWATER BACTERIA,

Harris County Pollution Control Dept. Houston,

S. C. Hulka, S. R. Keen, and E. M. Davis. Water and Sewage Works, Vol 120, No 10, p 79-81, October 1973. 4 tab, 14 ref.

Descriptors: \*Chlorination, \*Sediments, Waste water (Pollution), \*Enteric bacteria, \*Pathogenic bacteria, Bioindicators, Growth rates, \*Pollutant identification, Phytoplankton, Disinfection, Pseudomonas, Salmonella, E. coli, Streptococcus, \*Coliforms, Waste water treatment. Identifiers: Aftergrowth, Survival, Fecal streptococci.

Enumeration and identification of bacteria in wastewater collected from the overflow weirs of two secondary clarifiers, showed that significant aftergrowth of bacteria occurred when samples were chlorinated at a level of 1.0 mg/1. Total coliform bacterial counts, fecal coliform bacteria and the types considered 'non-coliform' all demonstrated remarkable regrowth. Fecal streptococci on the other hand, exhibited an appreciably slower die-off rate than in the nonchlorinated sample. The data suggest that chlorina tion effectively decreased the competitive bacterial populations. Surviving bacteria are listed. Survival of enteric bacteria in effluent from waste stabilization ponds was found to be distinctly related to phytoplankton concentrations. The results of survival tests after chlorination at levels up to 5.0 mg/1 with samples containing more than 20,000 areal standard units of phytoplankton suggest that if disinfection is incomplete, nutrients are present, and bacterial competion is reduced, indicator and pathogenic bacteria may reestablish. Indicator bacteria have also been found in sediments of unpolluted waters, and high levels were found in some cases where sediments were disturbed. It is recommended that rapid and more precise methods of generic identification be developed to eliminate erroneous conclusions which may occur from elevated counts of bacteria resulting from bacterial aftergrowth or natural populations. (Lit-W74-03295

EFFECTS OF RESIDUAL CHLORINE ON AQUATIC LIFE, National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C. W24.0398

BROWN SEAWEED AS AN INDICATOR OF HEAVY METALS IN ESTUARIES IN SOUTH-WEST ENGLAND,

Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab. For primary bibliographic entry see Field 05C. W74-03301

THE ZOSTERA EPIFAUNAL COMMUNITY IN THE YORK RIVER, VIRGINIA, Florida Atlantic Univ., Boca Baton. Dept. of

Florida Atlantic Univ., Boca Baton. Dept. of Biological Sciences. G. A. Marsh.

Chesapeake Science, Vol 14, No 2, p 87-97, June 1973. 5 fig, 1 tab, 27 ref.

Descriptors: \*Biological communities, \*Food webs, \*Fish food organisms, Marine plants, Marine animals, Biomass, Dominant organisms, Estuarine environment, Marine microorganisms, Crustaceans, Annelids, Mollusks, Nematodes, Rotifers, Diatoms, Marine fish, Diptera, Invertebrates, Marine algae, Scuba diving, \*Virginia, Depth, Water temperature, Gastropods, Amphipoda, Isopods, Shrimp, Biorhythms, Snails, Food habits, Sampling, Clams, Mussels, Speciation, Estuaries.

Identifiers: Epiphytes, \*Epifauna, Eelgrass, \*York River, \*Seasonal variation, Species abundance, Species diversity, Zostera marina, Macroinvertebrates, Flatworms, Acorn worms, Tunicates, Sponges, Bryozoa, Coelenterates, Nemerteans, Nutrient sources.

The invertebrate epifauna occurring on Zostera marina L. in the lower York River, Virginia, was sampled with the aid of SCUBA for 14 consecutive months from a collecting station located at each of three different water depths within a single eelgrass bed. The plants were clipped at their bases and the organisms were washed from the plants into a 0.5-mm sieve, then preserved in 8-10 percent seawater-formalin solution. Each blade was stripped of sediment, epiphytes and sessile fauna. Cleansed plants were oven-dried at 80C for 48 hr, then weighed to the nearest 0.1 g. A total of 112 invertebrate species were collected. The five most abundant non-colonial species (Bittium vari-um, Paracerceis caudata, Crepidula convexa, Ampithoe longimana and Erichsonella attenuata) accounted for approximately 59 percent of the total fauna. These species dominated the epifauna throughout most of the year. Several other species, including Balanus improvisus, Molgula manhattensis, Polydora ligni and Ercolania fuscata, were abundant for only brief periods. A relatively high average index of affinity (58 percent) between all synchronous sample pairs indicated a generally homogeneous fauna, although several species were differentially distributed with depth. Exfoliation of Zostera after June caused a steady decline in plant biomass, but the abundance of epifauna continued to increase into the summer and fall. Lowest total numbers and species counts occurred in February and early March. Diversity values (H') ranged from 1.92 to 3.90 bits/individual and averaged 3.04 bits/individual for all stations. High species numbers in summer were generally counteracted by relatively low equitabilities (epsilon), with H' showing little seasonal change. The primary sources of nutrition for the epifauna appeared to be (1) plankton and suspended particulate matter, (2) detritus and microorganisms on the plant blades, and (3) epiphytic algae. (Holoman-W74-03302

# Group 5A-Identification of Pollutants

STANDING CROP OF SALT MARSHES SUR-ROUNDING CHINCOTEAGUE BAY, MARY-LAND-VIRGINIA, Maryland Univ., Solomons. Natural Resources

Inst.

For primary bibliographic entry see Field 02L. W74-03304

THE BIOLOGY OF BROWN ALGAE ON THE ATLANTIC COAST OF VIRGINIA. II.
PETALONIA FASCIA AND SCYTOSIPHON LO-MENTARIA, Kent State Univ., Ohio. Dept. of Biological

Sciences.

R. G. Rhodes, and M. U. Connell.

Chesapeake Science, Vol 14, No 3, p 211-215, September 1973. 14 fig. 20 ref.

Descriptors: \*Plant growth, \*Phaeophyta, \*Plant morphology, Marine algae, Marine plants, Cultures, Germination, Water temperature, Salinity, Benthic flora, Sessile algae, Speciation, Biology,

Identifiers: \*Petalonia fascia, \*Scytosiphon lo-mentaria, Plant development, Culturing

Microscopic, brown algal crusts and filaments were collected in the summer from an oyster reef on the Atlantic coast of Virginia and isolated into culture. Developmental studies showed that the isolates were microscopic stages of Petalonia and Scytosiphon. These two brown algae exist the year around in the form of either microscopic or macroscopic plants. In culture no sexual reproduction was found linking the two stages of either Petalonia or Scytosiphon. The zoospores from the macroscopic plants of Petalonia and Scytosiphon developed directly into crusts and initials on the crusts developed directly into macroscopic plants. Culture conditions of 10C and a 9-15 hour photoperiod stimulated the development of macrothalli in both taxa. (Holoman-Battelle) W74-03309

DETERMINATION OF FATTY ACID COM-POSITION BY GAS CHROMATOGRAPHY: I. ANALYSIS WITH USE OF THERMAL CON-DUCTIVITY DETECTOR,

Japan Oil Chemist Society, Tokyo. Gas Chromatography Committee.

For primary bibliographic entry see Field 02K. W74-03311

DETERMINATION OF FATTY ACID COM-POSITION BY GAS CHROMATOGRAPHY: II. ANALYSIS WITH USE OF FLAME IONIZATION DETECTOR, Japan Oil Chemist Society, Tokyo. Gas Chro-

matography Committee.

For primary bibliographic entry see Field 02K. W74-03312

MULTIPARAMETER SEPARATOR NEW MICROSCOPIC PARTICLES FOR FOR MICROSCOPIC PARTICLES OF BIOLOGICAL CELLS, Los Alamos Scientific Lab., N. Mex. For primary bibliographic entry see Field 07B.

A CONTRIBUTION TO THE ECOLOGY AND DISTRIBUTION OF AQUATIC ACARI IN THE ST. LAWRENCE GREAT LAKES,

Wisconsin Univ., Milwaukee. Center for Great Lakes Studies. For primary bibliographic entry see Field 05C.

PREPARATION OF SLIDE PERIPHYTON FOR VARIOUS PRODUCTIVITY ANALYSES, Bemidji State Coll., Minn. Dept. of Biology For primary bibliographic entry see Field 07B.

W74-03315

STERILE CULTURE TECHNIQUES FOR SPE-CIES OF THE ROTIFER ASPLANCHNA. California Univ., Riverside. Dept. of Biology. R. C. Aloia, and R. L. Moretti.

Transactions of the American Microscopical Society, Vol 92, No 3, p 364-371, July 1973. 2 fig,

Descriptors: \*Bacteria, \*Rotifers, \*Protozoa, Methodology, Life cycles, Growth rates, Harvesting, Microorganisms, Invertebrates, Cultures, Population, Temperature, Centrifugation. Identifiers: \*Culturing techniques, Sterile cul-tures, Culture media, \*Growth media, Sample preparation, Asplanchna brightwelli, Paramecium

aurelia, Aerobacter aerogenes, Asplanchna sieboldi, Clones

Several new techniques are subscribed for culturing the rotifer Asplanchna brightwelli, the protozoan, Paramecium aurelia, and the bacterium Aerobacter aerogenes. The bacterium is grown at 37C, harvested by centrifugation, and stored in a separatory funnel in a concentrated suspension at 4C. Aliquots of the bacterial medium are fed to cultures of paramecia which are maintained at 31C. Portions of the paramecia solutions, in turn, are fed to rotifer populations at room temperature.

The entire culture scheme is sustained by employing aseptic procedures. Sterile culture conditions were maintained by working under aseptic hoods containing UV germicidal lamps turned on at all times. The glassware was vigorously washed in Tide, thoroughly rinsed in tap and distilled water, drained dry, wrapped in tin foil, and autoclaved at 15 psi for 20 min. Glassware used for chemicals was washed separately from that used for bacteria, paramecia, and rotifers. (Holoman-Battelle)

BIOTIC CHARACTER AS RELATED TO STREAM MINERAL CONTENT, North Dakota Univ., Grand Forks. Dept. of Biolo-

gy. For primary bibliographic entry see Field 05C.

AN AEROPHILOUS DIATOM COMMUNITY FROM HOCKING COUNTY, OHIO,
Bowling Green State Univ., Ohio. Dept. of Biolo-

R. L. Lowe, and G. B. Collins. Transactions of the American Microscopical Society, Vol 92, No 3, p 492-496, July 1973. 5 fig, 1 tab, 5 ref.

Descriptors: \*Diatoms, Biological communities, \*Cytological studies, \*Ohio, Aquatic habitats, \*Ecological distribution, \*Aerobic conditions, Dominant organisms, Winter, \*Electron microscopy, Aquatic algae, Chrysophyta, Systematics. Identifiers: Scanning electron microscopy, Sample

preparation, Species abundance, Cell morphology, Achnanthes coarctata, Achnanthes lanceolata, Achnanthes lanceolata var. dubia, Amphora ovalis var. lybica, Amphora ovalis var. pediculus, Caloneis aerophila, Caloneis bacillum, Cocconeis placentula, Cocconeis placentula var. euglypta, Cymbella prostrata, Cymbella sincuata, Cymbella tumida, Frustulia vulgaris, Gomphonema acu-minatum, Gomphonema angustatum var. sar-cophagus, Gomphonema parvulum, Hantzschia

An aerophilous winter diatom community consisting of 41 taxa was dominated by Melosira roseana Rabh., both in terms of number of cells and bio-Scanning electron microscopy revealed details of M. roseana auxospore and vegetative cells not previously reported. (Holoman-Battelle) W74-03318 STREPTOCEPHALUS MOOREI N. SP., A NEW FAIRY SHRIMP (ANOSTRACA) FROM MEX-

Arizona State Univ., Tempe. Dept. of Zoology. For primary bibliographic entry see Field 02I. W74-03319

OBSERVATIONS ON RED COLORED CELLS OF PERIDINIUM WISCONSINENSE FROM BUCKHORN LAKE, ONTARIO, Guelph Univ. (Ontario). Dept. of Zoology. For primary bibliographic entry see Field 05C. W74-03320

STATISTICAL PREDICTION OF EQUILIBRIUM TEMPERATURE FROM STANDARD METEOROLOGICAL DATA BASES,

874, \$1.45. Environmental Protection Agency, Technology Series, Report EPA-660/2-73-003, Au-gust 1973. 271 p, 63 fig, 16 tab, 5 ref. EPA Project 16130 GSD. 68-01-0167.

Descriptors: \*Water temperature, \*Stochastic processes, Statistical models, Mathematical models, \*Energy budget, Heat budget, Meteorolomous, \*Energy budget, Processing, \*Forecasting, \* Meteorological data, Air-water interfaces, Distribution patterns. Identifiers: \*Equilibrium water temperature,

Water temperature prediction.

A computer program has been written and applied to investigate the stochastic distribution of equilibrium temperature as determined from a standard meteorological data base. The equilibrium temperature at an air-water interface is the temperature which would be attained by the surface if the net heat flow through it were zero. Since it is a basic factor in the prediction of actual water temperatures, the distribution of equilibrium temperature, and hence of water temperature, is an important statistic. In the process, data from three cities (Fresno, California; Boston, Mas-sachusetts; and Portland, Oregon) and for several time periods were compared through use of U.S. Weather Bureau hourly observations of surface and solar weather data, collected over 10 years. The conclusions arrived at concern both the use of the data and the computation of the distribution of equilibrium temperature. (EPA)

GEOCHEMICAL HYDROLOGY OF THE BATON ROUGE AQUIFERS,
Louisiana State Univ., Baton Rouge. School of Geoscience. For primary bibliographic entry see Field 04B. W74-03335

TRACE-ELEMENT DISTRIBUTION IN THE

CONTINENTAL-SHELF SEDIMENTS OFF THE EAST COAST OF INDIA, Andhra Univ., Waltair (India). Dept. of Geology. For primary bibliographic entry see Field 02J. W74-03350

AN EVALUATION OF WATER-QUALITY DATA OBTAINED AT FOUR STREAMFLOW DAILY-RECORD STATIONS IN IDAHO, Geological Survey, Boise, Idaho.
K. L. Dyer.
Available from NTIS, Springfield, Va. 22151 PB-

224 066 Price \$5.00 printed copy; \$1.45 microfiche. Water-Resources Investigations 30-73, August 1973. 51 p, 4 fig, 1 tab, 5 ref, 4 append.

Descriptors: \*Water quality, \*Surface waters, \*Idaho, \*Streamflow, Correlation analysis, Flow

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Identification of Pollutants—Group 5A

rates, Streams, Chemical analysis, Water analysis, Regression analysis, Hydrologic data, Reviews,

Four streamflow water quality stations in Idaho with historical records ranging from 7 to 22 years were analyzed statistically to show the functional relationships of the major inorganic chemical constituents to specific conductance and stream discharge. The data for each of the three long-term stations were subdivided into approximately fiveyear segments; then plots and regression equations were derived for each record segment in order to assess changes in constituent relations with time. In general, highly significant correlations were ob-served between the major inorganic ions and specific conductance. Correlations were usually observed between these same ions and discharge. The only significant change in chemical characteristics with time occurred at the Boise River at Notus, where the percentages of chlorides and sulfates in solution declined appreciably between 1940 and 1951 while bicarbonate percentages increased. At two stations the common discharge relations were more highly correlated before 1957 than thereafter, presumably because of construction of upstream dams and changes in water regulation. (Woodard-USGS)

IS PHOSPHATE REDUCED TO PHOSPHINE IN

WATERLOGGED SOILS, Reading Univ. (England). Dept. of Soil Science. For primary bibliographic entry see Field 02G. W74-03523

MICROELEMENT CONTENT AND REGIME IN WATER AND SUSPENDED SOLIDS IN THE VOLGA RIVER BASIN (SODERZHANIYE I REZHIM MIKROELEMENTOV V VODE I VO VZVESHENNYKH VESHCHESTVAKH V BAS-SEYNE R. VOLGI),

Gidrokhimicheskii Institut. (USSR).

For primary bibliographic entry see Field 02K. W74-03533

RECENT STUDIES OF MERCURY ANALYSIS PROCEDURES FOR MILL EFFLUENTS,

National Council of the Paper Industry for Air and Stream Improvement, Inc., New York W. L. Carpenter.

NCASI Stream Improvement Technical Bulletin, No. 263, December 1972. 49 p, 6 fig, 8 tab, 3 appends, 36 ref.

Descriptors: \*Mercury, Water analysis, \*Analytical techniques, \*Spectrophotometry, \*Pollutant identification, \*Monitoring, Effluents, Industrial wastes, Pulp and paper industry, \*Pulp wastes, Calibrations, Instrumentation, Trace elements, Chemical analysis, Fish, Organic compounds, Inorganic compounds, Oxidation.

Identifiers: Flameless atomic absorption spec-troscopy, Atomic absorption spectroscopy, Per-sulfate oxidation, Persulfates.

A review is presented key instrumental and special chemical aspects of flameless atomic absorption analysis and the superiority of persulfate oxidation in the presence of acids for converting organic mercury (Hg) to its inorganic form. It also provides information on the preparation of instrument calibration curves and identifies possible sources of analytical errors and means for avoiding them. It concludes that although Hg can be detected in water samples at levels as low as 0.35 ppb (parts per billion), the practical limit of detection in mill effluent samples is 1 ppb, using a reasonable number of replicate analytical determinations. Flameless atomic absorption analysis provides a reliable technique for routine monitoring of pulp and paper mill effluents to detect Hg. Two appendices describe the EPA procedure (January 1972) and the TVA procedure for Hg analyses; a third appendix compares Hg concentrations in fish tissue as measured in several laboratories by different procedures. (Witt-IPC)

AN INVESTIGATION OF ATOMIC ABSORP-TION ANALYSIS OF MILL EFFLUENT METAL

ION CONTENT, National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.

NCASI Stream Improvement Technical Bulletin. No. 262, December 1972. 58 p, 12 fig, 12 tab, 6 ap-

Descriptors: Water analysis, \*Analytical techniques, \*Cations, \*Metals, \*Spectroscopy, \*Analytical \*Pollutant identification, Waste water (Pollution), Zinc, Lead, Copper, Chromium, Cadmium, Nickel, Manganese, Magnesium, Calcium, Effluents, \*Pulp wastes, Pulp and paper industry, Standards, Specifications. Identifiers: Atomic absorption spectroscopy.

The analytic capabilities of techniques described in 'Standard Methods for Examination of Water and Wastewater' for detecting the presence of Zn, Cu, Cd, Pb, Ni, Mn, Mg, and Ca in pulp and paper mill effluents were investigated. The atomic absorption technique was selected as the best presently available standard method. It was used to determine the metal cation contents of 23 mill effluent samples. Limits of detection for each cation were established, along with relative standard deviations. The fundamental principles and features of atomic absorption analysis are described. Problems that may be encountered in determining each of the nine metal cations are indicated. Guidelines are given for requesting heavy metal analyses from service laboratories and for evaluating the reported data. (Witt-IPC) W74-03543

# GAS CHROMATOGRAPHIC DETERMINATION OF METHYL MERCURY IN FISH, SEDIMENT,

National Environmental Research Center, Cincin-

J. E. Longbottom, R. C. Dressman, and J. J.

Lichtenberg.

Journal of the Association of Official Analytical Chemists, Vol 56, No 6, p 1297-1303, November 1973. 2 fig, 1 tab, 12 ref.

Descriptors: \*Water analysis, \*Mercury, \*Pollu tant identification, Fish, Sediments, \*Analytical uant ioenturication, Fish, Sediments, \*Analytical techniques, \*Gas chromatography, Chromatography, Chemical analysis, Organic compounds, Inorganic compounds, Correlation analysis.

Identifiers: Mercury compounds, \*Methyl mercu-

Methyl mercury is extracted as the bromide salt from fish and sediment, and as the chloride salt from water samples. All extracts are purified by a procedure using sodium thiosulfate and potas iodide to convert methyl mercury to the iodide salt for analysis by electron capture gas chromatography. Average recoveries ranged from 88.5% for water samples to 95.5% for perch and 96.3% for sediment samples. Column and detector poisoning were two particular problems encountered. Procedures for controlling contaminants and inter-ferences are indicated. When the method was applied to sediment samples from a polluted river, a correlation was found between methyl mercury and total mercury concentrations when the latter ranged between zero and 10 microgram. The correlation failed for samples of high inorganic Hg content. (Brown-IPC)

ANALYSIS OF TRACE ORGANIC COM-POUNDS IN NEW ENGLAND RIVERS, Massachusetts Inst. of Tech., Cambridge. Dept. of

Chemical Engineering.

Journal of Chromatographic Science, Vol 11, No 11, p 570-574, November 1973. 4 fig, 2 tab, 13 ref.

Descriptors: \*Water analysis, \*Water pollution sources, \*Pollutant identification, \*Organic compounds, \*Massachusetts, New England, \*Industrial wastes, \*Chemical wastes, Textiles, Plastics, Analytical techniques, Chemical analysis, Waste water (Pollution), Chemical industry, Dye releases, Additives.

Identifiers: Plasticizers, Merrimack River (Mass), Monatiquot River (Mass).

Waters from the Monatiquot and Merrimack waters from the Monauquot and Merrimack Rivers (Massachusetts) were examined for presence of anomalous lipophilic organic com-pounds, using computer-aided gas-chromatog-raphy/mass spectrometry and high-resolution mass spectrometry. Several plasticizers of the dialkyl phthalate and adipate type were found in the Monatiquot River in 1-300 ppb amounts, probably originating from discharges of a plastics factory. The Merrimack River samples contained 0.1-0.5 ppb traces of biphenyl, trichlorobenzene, and butyl benzoate, all commonly used as dye bath ad-ditives and hence attributable to textile factories, notably effluents of the New England synthetic fiber industry. (Brown-IPC)

REVIEW OF RAPID BOD TEST METHODS, Beak (T. W.) Consultants Ltd., Montreal

Canadian Department of the Environment, Pulp and paper Pollution Abatement, Project Report 138-1, July 31, 1972. 24 p, 1 tab, 33 ref.

\*Biochemical oxygen \*Analytical techniques, \*Water analysis, \*Pulp wastes, Pulp and paper industry, Volumetirc analysis, Measurement, Testing procedures, Water quality control, \*Reviews, Methodology. Identifiers: Short-term BOD tests.

A literature review of short-term BOD test methods resulted in the evaluation of several techniques used to predict or simulate the conven-tional five-day BOD standard dilution method. The most promising substitute methods applicable to the needs of the pulp and paper industry include determination of one-day BOD at 37C, acidimetric titration, and measurement of total BOD. (Brown-IPC) W74-03557

THE CHIRONOMIDS OF THE PERIPHYTON IN THE YUGOSLAV PART OF THE RIVER DANUBE (DIE CHIRONOMIDENFAUNA AUS DEM PERIPHYTON IN DER JUGOS-LAWISCHEN DONAUSTRECKE), Institute for Biological Research, Belgrade (Yu-

Archiv fur Hydrobiologie, Vol 44, No 2, p 249-257, March 1973. 5 tab, 6 ref. (English summary).

Descriptors: \*Aquatic insects, \*Water pollution effects, \*Periphyton, Midges, Dominant organisms, Speciation, Systematics, Biological communities, Secondary productivity, Ecological distribution, Diptera, Aquatic animals, Waste water (Pollution), Industrial wastes, Municipal wastes, Larvae, Invertebrates.

Identifiers: \*Danube River, \*Chironomids, Species abundance, \*Yugoslavia, Ablabesmya gr. lentiginosa, Diamesa insignipes, Brillia longifurca, Cricotopus algarum, Cricotopus bicinctus, Cricotopus biformis, Cricotopus latidentatus, Criotopus silvestris, Cricotopus trifascia, Eukief-

# Group 5A—Identification of Pollutants

feriella bavarica, Limnophyes septentrionalis, Microcricotopus bicolor, Euorthocladius rivicola, Rheorthocladius rhyacobius, Rheorthocladius rubicundus, Rheorthocladius saxicola, Polypedilum gr. convictum. Polypedilum gr. laetum

A preliminary account is given of the fauna of a stretch of the Yugoslav part of the Danube, 50 km long. The results were obtained at the beginning of April 1971. Twenty-one species of chironomid were recorded in the Danube between Belgrade and Smederevo, 70 percent of them for the first time. Eighty-one percent of the species were of the subfamily Orthocladiinae. Cricotopus algarum, the commonest and most abundant species was the only one which occurred in all the localities. Less frequent but almost as abundant was Rheorthocladium rubicundus. Rh. rhyacobius was also important despite its relatively low abundance. The subfamily Chironominae was represented only by 3 species, two of them playing periodically a more or less important role in the periphyton fauna. More frequent was Polypedilum gr. convictum, which exhibited considerable production in the polluted part of the Danube where another species of the genus, P. gr. laetum, was the predominant species. The municipal and industrial wastewaters reduce the number of chironomid species and cause changes of their composition. Thus species of Chironominae were predominant in places affected by the iron smelter, whereas Orthocladiinae predominated in the part polluted by municipal wastewaters as well as in the clean sector of the Danube. (Holoman-Battelle) W74-03562

FISHES AS INDICATORS OF WATER QUALI-TY AND THEIR SIGNIFICANCE FOR ECONOMIC USE (FISCHE ALS INDIKATOR DER GEWASSERGUTE UND IHRE BEDEU-TUNG FUR DIE WASSERWIRTSCHAFTLICHE NUTZUNG),

Institute for Biological Research, Belgrade (Yugoslavia). D. Jankovic.

Archiv fur Hydrobiologie, Vol 44, No 2, p 222-228, March 1973, 23 ref. (English summary).

Descriptors: \*Bioindicators, \*Water quality, \*Industrial wastes, \*Sewage effluents, \*Mine wastes, \*Farm wastes, Freshwater fish, Water pollution effects, Toxicity, Resistance.

Identifiers: \*Danube River, Alburnus alburnus, Chondrostoma nasus, Scardinius erythrophthal-mus, Blica bjoerkna, Cyprinus carpio, Acipenser enus, Stizostedion lucioperca.

Fishes react differently to the intensity and nature of pollution, which makes them useful as indicators of water quality. Alburnus alburnus L., Chondrostoma nasus L., Scardinius erythrophthalmus L., Blica bjoerkna L., and others are rather tolerant of wastewaters of industry, mining and sewage from villages and agriculture. The decrease of economically valuable fish species, Cyprinus carpio carpio L., Acipenser ruthenus L., Stizostedion lucioperca L., and others, in the Danube and its tributaries depends on various factors, one of them being the pollution caused by untreated effluents. The knowledge of these adverse effects on the fauna of the Danube system makes possible an actual project for the development of fisheries. (Little-Battelle) W74-03563

TITRIMETRIC DETERMINATION OF URANI-**UM WITH ELECTROGENERATED VANADIUM** 

New Brunswick Lab. (AEC), N.J. For primary bibliographic entry see Field 02K.

# IODIDE OXIDATION BY A MARINE BACTERI-

Technion - Israel Inst. of Tech., Haifa. Dept. of Food Engineering. R. S. Gozlan, and P. Margalith.

Journal of Applied Bacteriology, Vol 36, No 3, p 407-417, September 1973. 8 fig. 5 tab, 28 ref.

Descriptors: \*Iodine, \*Sea water, \*Oxidation, Re-Descriptors: "Joune, "Sea water, "Oxidation, Resistance, Systematics, Electron microscopy. Identifiers: "Pseudomonas iodooxidans, "Cell morphology, "Iodine cycle, Mobilization, Sample preparation, Culture media.

Death of euryhaline fish in an aquarium was caused by iodine liberated in seawater by a marine bacterium. The isolation of a pure culture of Pseudomonas iodooxidans sp. nov., highly resistant to iodine, led to the elucidation of the mechanism involved. Iodides were oxidized to free iodine by an extracellular peroxidase system and hydrogen peroxide was generated by the bacteria. The importance of this finding is discussed in the light of current knowledge of the iodine cycle in nature. W74-03565

DISSOCIATION IN A MARINE PSEU-DOMONAD, Macdonald Coll., Ste. Anne de Bellevue (Quebec).

Dept. of Microbiology.

J. A. Gow, I. W. DeVoe, and R. A. MacLeod.

Canadian Journal of Microbiology, Vol 19, No 6, p
695-701, June 1973. 3 fig, 3 tab, 21 ref.

Descriptors: \*Marine bacteria, Isolation, Radioactivity techniques, Growth rates, Sodium, Salt nutrients, Deficient elements, Absorption.
Identifiers: \*Pseudomonads, \*Bacterial physiolo-

gy, Characterization, \*Dissociation, Bioaccumulation, Alpha-Aminoisobutyric acid, Culture media, Protoplasts, Cell morphology, Nutrient media.

Eight morphological variants, the product of colonial dissociation, were isolated from cultures of the marine pseudomonad B-16. Features which distinguished the variants were smooth versus rough colony type, the presence or absence of color, and differences in colony diameter. The variants differed in their capacity to form stable protoplasts and to grow at suboptimal Na (plus) concentrations in defined medium. All, however, required Na (plus) for growth. The ability of the organism to accumulate alpha-aminoisobutyric acid (AIB) and the requirement for Na (plus) for this process was not affected by dissociation. (Holoman-Battelle) W74-03566

AQUATIC SEDIMENT AS A HABITAT OF EMERICELLOPSIS, WITH A DESCRIPTION OF AN UNDESCRIBED SPECIES OF CEPHALOSPORIUM,

Institute for Fermentation, Osaka (Japan). K. Tubaki.

Mycologia, Vol 65, No 4, p 938-941, July/August 1973. 4 fig, 1 tab, 13 ref.

Descriptors: \*Marine fungi, \*Muds, \*Sea water, \*Brackish water, Systematics, Salinity, Habitats. Identifiers: \*Emericellopsis humicola, Emericellopsis minima, Emericellopsis microspora, Cephalosporium polyaleurium, \*Japan, Culture

During a survey of the marine, brackish-, and fresh-water fungi of Japan, three species of Emericellopsis were isolated from the muds of four sites: 26 strains of E. humicola, 3 strains of E. minima, and 6 strains of E. microspora. All three species belong to the small-spored section of the genus. Cephalosporium was also found to be common in muds either as conidial states of Emercellopsis or as imperfect states only. A new species, C. polyaleurum, is described which is common in coastal muds and is characteristic both in the smaller amount of conidial production and in the formation of numerous aleuriospores. This fungus grew better on 30-100 percent seawater medium (with 1 percent glucose and 0.1 percent yeast extract) than on freshwater medium. (Little-Battelle) W74-03568

DIRECT FLUORESCENT-ANTIBODY TECHNIQUE FOR THE MICROBIOLOGICAL EXAMINATION OF FOOD AND ENVIRONMENTAL SWAB SAMPLES FOR SALMONEL-

General Foods Corp., Battle Creek, Mich. Post Div. Research. N. F. Insalata, C. W. Mahnke, and W. G. Dunlap.

Applied Microbiology, Vol 26, No 3, p 268-270, September 1973, 1 tab, 12 ref.

Descriptors: \*Salmonella, Cultures, \*Pollutant identification, Foods.
Identifiers: \*AOAC Methods, \*Fluorescent an-

tibody techniques, Method evaluation, Swab sam-

Comparative studies of a modified fluorescent-antibody (FA) procedure and the 5 to 7 day method used by the Association of Official Analytical Chemists for the detection of Salmonella were made on 151 samples of wheat products and 183 swab samples from in-process equipment. The agreement between the two methods for the 334 samples tested was 92.5 percent. Food samples yielded 94.7 percent agreement, whereas the swab samples yielded 90.7 percent agreement. There were 7.5 false positives for the total number of samples tested. No false negatives were obtained by using the fluorescent-antibody method. The study also demonstrated that pooling suspect samples is possible to permit larger numbers t tested simultaneously by FA. (Little-Battelle) W74-03569

QUANTITATIVE EXTRACTION OF ADENOSINE TRIPHOSPHATE FROM CULTIVABLE AND HOST-GROWN MICROBES: CALCULATION OF ADENOSINE TRIPHOSPHATE POOLS,

Johns Hopkins Univ., Baltimore, Md. Dept. of

Sample preparation.

Pathobiology.

A. M. Dhople, and J. H. Hanks.
Applied Microbiology, Vol 26, No 3, p 399-403,
September 1973. 3 tab, 7 ref.

Descriptors: \*Separation techniques, \*E. coli, Enteric bacteria, Bioluminescence. Identifiers: \*Adenosine triphosphate, \*Mycobacterium phlei, \*Mycobacterium lepraemurium,

Existing data on adenosine triphosphate (ATP) pools in microbes are deficient for two reasons: (1) incomplete extractions of ATP, and (2) the failure to take into account that the adverse effects of ex-tracting procedures on standard ATP exert analogous effects on the ATP released from bac-terial cells. Methods for correcting observed yields terial cens. Methods for conferenting observed years and calculating ATP pools have been demon-strated. Three bacterial species were used in the studies on extraction of ATP: Escherichia coli, Mycobacterium phlei, and Mycobacterium lepraemurium. Perchloric acid and n-butanol were disqualified because of inconvenient procedures. The new extraction procedure had minimal effects on standard ATP, liberated 100 percent of the ATP pools from the three representative species of microbes, and caused no ionic imbalance or quenching of bioluminescence. This method involves vortexing of cell suspensions for 10 s with 23 percent chloroform (vol/vol), heating at 98 C for the required time (E. coli, 3 min; M. phlei, 5 min; M. lepraemurium, 10 min) and then 1 min at 98 C with vacuum to dry the samples. Heat or chloroform alone may suffice for some microbes and release total ATP from plant and animal cells. (Little-Battelle)

# A SENSITIVE BIO-BEHAVIORAL ASSAY FOR METHYL MERCURY, Waterloo Univ. (Ontario). Dept. of Psychology.

Bulletin of Environmental Contamination and Toxicology, Vol 10, No 3, p 166-169, September 1973. 1 fig, 1 tab, 4 ref.

Descriptors: \*Bioassay, \*Animal behavior, Mer-cury, Heavy metals, Water pollution effects, Tox-icity, Monitoring, Bioindicators.

Identifiers: \*Methy \*Methylmercury, \*Spider webs,

Since slight changes in physiology or metabolism of the spider result in alteration of web structure, were conducted to investigate whether methylmercury could be detected in this way. Spiders (Araneus diadematus) were allowed to construct webs in specially designed cages. After photographing the webs daily for a suitable period of time, spiders were fed small amounts of methyl mercuric chloride in a drop of sugared water along with a fruit fly. Four groups of spiders were fed doses of 1, 2, 5, 50 micro micrograms/day. Two general effects of exposure were observed: web structure and frequency of web building were altered. At low doses (1 and 2 micro micro-grams/day) web building was facilitated during two weeks of exposure. At these dosages, detail and size of webs also increased in more than half the webs for two weeks after which small and distorted webs predominated. At the higher doses (5 and 50 micro micrograms/day) frequency of web construction decreased to the point of complete elimination. The webs that were built were generally much smaller and less detailed than normal. This bioassay procedure is extremely sensitive and should be valuable for monitoring suspected environmental sources of contamination. (Little-Battelle) W74-03572

# PRODUCTION OF BACTERIOPHAGE BY LYO-PHILIZED AND OXYGEN-EXPOSED PHILIZED AND ESCHERICHIA COLI,

Israel Inst. for Biological Research, Nes Ziyyona. E. Israeli, and A. Shapira.

Journal of General Microbiology, Vol 79, No 1, p 159-161. November 1973. 1 tab. 10 ref.

Descriptors: \*E. coli, \*Oxygen, \*Bacteriophage, \*Freeze drying, Bioindicators, Proteins, Analyti-cal techniques, Synthesis, Cultures. Identifiers: \*Lyophilized bacteria, DNA, FDO bacteria, RNA, Survival.

An investigation was conducted to determine whether protein and DNA synthetic mechanisms could function correctly under some other control than that of the cell. E. coli strains were used to investigate the ability of freeze-dried, oxygen-exposed (FDO) bacteria to produce phage. There was no difference in the burst size in phage-infected bacteria between FDO and control organisms. These results suggested that the mechanism of DNA and protein synthesis in FDO bacteria remained intact after oxygen exposure, and was able to function only under a different control. Although the present results do not show any difference in response to phage infection between lyophilized and FDO bacteria, the phage produc-tion capacity of lyophilized bacteria before or after exposure to oxygen was only 10 percent of non-lyophilized controls. The percentage of bac-teria producing phage was related to the percentage of microscopically observed filamentous forms in the population of such pre-incubated, lyo-philized as well as FDO bacteria. It seems that the main cause of death of bacteria upon freeze-drying and exposure to 02 is not damage to DNA, RNA or protein synthesis mechanisms per se, but rather interference with a control mechanism, probably linked with the initiation of the new reproductive cycle. (Mortland-Battelle)

# DETERMINATION OF TRACE ORGANICS IN

AIR AND WATER, Monsanto Co., St. Louis, Mo. J. P. Mieure, and M. W. Dietrich.

Journal of Chromatographic Science, Vol 11, No 11, p 559-570, November 1973, 15 fig, 8 tab, 12 ref.

Descriptors: \*Potable water, \*Waste water (Pollution), \*Organic compounds, \*Gas chromatography, \*Separation techniques, Rivers, Organic raphy, Separation techniques, Arvers, Organic wastes, "Pollutant identification, Solvents, Phenols, Alcohols, Nitrogen compounds, Aro-matic compounds, Ethers, Industrial wastes, Sul-fides, Pesticides, Water pollution, Air pollution. Identifiers: Methylene chloride, Carboxylic acids, Amides, Esters, Aliphatic amines, Anilides, Sam-Amines, Esters, Alphaiuc amines, Anindes, Sample preparation, Butyl benzyl phthalate, Butyl diphenyl phosphate, Heterocyclics, Aldehydes, Ketones, Methanol, Acetone, Benzene, Chloroform, Aniline, Methyl isobutyl ketone, mcresol, o-Ethylphenol, p-Ethylphenyl, Chromato-

Several procedures have been developed for measuring trace organics in air and water matrices. These methods use only the equipment and apparatus normally found in an analytical laboratory, and require a minimum of operator training. The scheme used for analyzing both air and water consists of the following operations: (1) The organics are concentrated and isolated from the matrix. (2) The components of interest are identified. (3) The identified compounds are measured. The second two operations are based primarily on gas chromatography (GC) and utilize relatively standard techniques. These are basically the same for air or water. Three specific procedures for determining trace organics in water, particularly waste water are described. The identification and quantitation steps are basically the same for the three procedures and use standard GC techniques. The procedures differ in their method of sample concentration. One is based on liquid-liquid extraction, another on head space sampling and the third on concentration with a packed column. Analysis water, waste water, and river water revealed the presence of a number of organic com-pounds. (Mortland-Battelle) W74-03576

# COMPLEXING CAPACITY OF NATURAL WATER - ITS SIGNIFICANCE AND MEASURE-

MENT, Dept. of Environment, Burlington (Ontario). Centre for Inland Waters.

V K Chan

Journal of Chromatographic Science, Vol 11, No 11, p 579, November 1973. 1 tab, 10 ref.

Descriptors: \*Trace elements, \*Copper, \*Ions, Chelation, Photosynthesis, Absorption, Lake Ontario, Lake Erie, Water pollution effects.

Identifiers: \*Complexing capacity, \*Anodic stripping voltammetry, Ligands, Chelating agents.

The abundance of complexing ligands in a body of water determined the complexing capacity of the water and hence its regulating capability. The measurement of complexing capacity of a water sample is based on the amount of copper ion being complexed by the organic ligands through direct complexation and/or displacement reaction. It is done by spiking several aliquots of a sample with increasing amounts of a copper solution. Then the uncomplexed copper is measured by a differential pulse anodic stripping voltammetric technique. After the complexing ligands in the sample have been saturated with copper, the peak current of free copper will increase linearly with the amount of the copper spikes. By extrapolating this linear curve back to zero peak current, the intercept of the X-axis represents the complexing capacity of the water expressed as equivalents of micro mole Cu/l. As the differential pulse anodic stripping voltammetry measurement of 'free' copper is carried tammetry measurement of tree copper is carried out in a system containing excess of copper ions, the peak current thus obtained represents the concentration of 'free' copper. The amount of copper plated out from the labile complexes, if any, becomes insignificant. The significance of complexing capacity of water on the effect and toxicity of copper ion on algal photosynthesis has also been investigated elsewhere using the C-14 uptake technique with lake waters of different complexing capacity and with the original plankton species.
(Mortland-Battelle) W74-03578

# A METHOD FOR THE HIGH TEMPERATURE GAS CHROMATOGRAPHIC ANALYSES OF

PETROLEUM RESIDUES, Bedford Inst., Dartmouth (Nova Scotia). Atlantic

Oceanographic Lab.
E. M. Levy, L. R. Webber, and J. D. Moffatt.
Journal of Chromatographic Science, Vol 11, No
11, p 591-593, November 1973. 3 fig, 5 ref.

Descriptors: \*Oil wastes, \*Gas chromatography, \*Separation techniques, Oil pollution, Oil spills,
\*Pollutant identification.
Identifiers: Crude oil, Oil residues, Fuel oil,

\*Hydrocarbons.

An analytical procedure is described by which crude oils, residual fuel oils and pollution samples can be analyzed by high temperature gas chromatography without pretreatment of the sample. Problems, which would otherwise arise from conresidues in the oils, are avoided by placing the sample in an aluminum boat in which the involatile residues are retained. The technique is as follows: with the carrier gas flowing through the system, the detector at the operating temperature (400 C), and both the column and injection port at room temperature, the septum nut and aluminum disc are removed from the instrument and the boat containing the weighed sample is placed into the injection port. The injection port is reclosed and its temperature increased to a few (about 10 C) degrees below 400 C. Substances with an appreciable vapor pressure at this temperature are swept onto the comparatively cold column where presumably they condense. After the injection port has been maintained at this temperature for approximately five minutes, the sample boat con-taining the involatile residue is removed from the injection port. The temperature of the column is then increased at 6 C/min to 400 C. This temperature program proved to be appropriate for the analysis of the higher boiling constituents in a wide variety of crude oil, residual fuel oils, and pollution samples. (Mortland-Battelle) W74-03579

# A MULTIPLE SPECIFIC ION DETECTOR AND ANALOG DATA PROCESSOR FOR A GAS CHROMATOGRAPH QUADRUPOLE MASS SPECTROMETER SYSTEM,

California Univ., Los Angeles. Dept. of Pharmacology. ry bibliographic entry see Field 02K.

# PHOTOCHEMISTRY OF BIOACTIVE COM-

PHOTOCHEMISTRY OF BIOACTIVE COM-POUNDS. KINETICS OF SELECTED S--TRIAZINES IN SOLUTION, Michigan State Univ., East Lansing. Dept. of Chemistry, Michigan State Univ., East Lansing. Dept. of Entomology. L. O. Ruzo, M. J. Zabik, and R. D. Schuetz. Journal of Agricultural and Food Chemistry, Vol 21, No 6, p 1047-1049, November/December 1973. 4 fig, 2 tab, 10 ref.

# Group 5A-Identification of Pollutants

Descriptors: \*Triazine pesticides, \*Pesticide kinetics, \*Pollutant identification, Aqueous solutions, Chromatography, Light, Irradiation, \*Organic compounds.
Identifiers: Photochemistry, Methanol, n-Butyl al-

cohol, Photolysis, Thin layer chromatography, Fate of pollutants, Photodecomposition.

The purpose was to extend the knowledge of the photochemistry of symmetrical substituted triazines. The rate variations caused by solvent and substituent effects indicate certain characteristics of the excited state which will be useful in the understanding of their photoreactions. The rate constants (k) for several 2-methylthio and 2halo-4, 6-bias (alkylamino)-s-triazines were calculated in methanol, n-bytyl alcohol, and water solutions. The rate of disappearance of the starting material (I-XII) was found to be dependent on the nature of the halogen and alkyl substituents and the solvent employed. A decrease in k was observed in the order I-Br-Cl-F and -C2H5 greater than -C3H7. All photoreactions showed zero-order rate constants. The rate constant in methanol was found to be considerably greater than that calculated in n-butyl alcohol. (Mortland-Battelle)

**PHOTODECOMPOSITION** -CHLOROPHENOXYACETIC ACID, California Univ., Davis. Dept. of Environmental Toxicology.
For primary bibliographic entry see Field 05B.

**PHOTODECOMPOSITION** OF TRICHLOROPHENOXYACETIC ACID (2,4,5--T) IN WATER, California Univ., Davis. Dept. of Environmental

Toxicology.
For primary bibliographic entry see Field 05B.

W74-03585

MODIFIED ATOMIC ABSORPTION SPECTRO-SCOPIC METHODS IN ANALYSES OF TRACE METALS (MODIFIZIERTE ATOMABSORP-TIONSSPEKTROSKOPISCHE ZUR METALLSPUREN-ANALYTIK), Farbenfabriken Bayer A. G., Leverkusen (West

Germany). Organisch Analytisches Laboratorium. G. Buttgereit.

Zeitschrift fur Analytische Chemie, Vol 267, No 2, p 81-88, November 1, 1973. 5 fig, 5 tab, 5 ref.

Descriptors: \*Spectroscopy, \*Trace elements, \*Urine, \*Metals, Absorption, Viscosity, Surface ten-sion, Mickel, Gold, Iron, Manganese, Lead, Chromium, Cadmium, Aluminum, Calcium, Copper, Mercury, Potassium, Sodium, Cobalt, Molybdenum, Titanium, Zinc, Heavy metals, Magnesium.

Identifiers: \*Atomic absorption trophotometry, Blood, Biological samples, Serum, Indium, Lithium, Silver, Arsenic, Barium,, Antimony, Selenium, Vanadium, Bismuth.

The basis of this report about atomic absorption spectroscopy with and without flame is the recognition and elimination of interferences. Interferences which are caused by the bonding state of the atoms, background absorption, viscosity and surface tension changes are discussed with the aid of examples for flame AAS including sample boat technique. A laboratory-made device with background compensator for the flameless mercury analysis, and a laboratory-made tantalum furnace for the flameless high temperature method are presented. The interferences by absorption superimpositions and optimizations in the direct analysis of heavy trace metals in urine, blood or serum are discussed in detail for commercial grahite furnaces. (Mortland-Battelle) W74-03586

CHARACTERIZATION AND MICRODETER-MINATION OF A WATER-SOLUBLE METABOLITE FROM BLADEX HERBICIDE BY WATER-SOLUBLE TO 5,5-DIMETHYLHYDA-CONVERSION NTION.

Shell Development Co., Modesto, Calif. S. C. Lau, D. B. Katague, and D. W. Stoutamire. Journal of Agricultural and Food Chemistry, Vol 21, No 6, p 1091-1094, November/December 1973. 5 fig, 8 ref.

Descriptors: \*Herbicides, \*Gas chromatography, \*Pollutant identification, Cation exchange, Aqueous solutions, Separation techniques, Crops, Soil analysis. Water analysis.

Identifiers: \*Bladex hebicide, Gas liquid chromatography, Thin layer chromatography, matography, Thin layer chromatography, Cleanup, Metabolites, Electron capture gas chromatography, Sensitivity, Sample preparation, Recovery.

A gas chromatographic method has been designed for the characterization and measurement of Bladex heribicide (propionitrile, 2-4-chloroethylamino-s-triazin-2-ylamino)-2-methyl-) and its various metabolites. It involves the simultaneous cleavage of the Bladex triazine ring and the cyclization of the characteristic Bladex fragment to 5,5-dimethylhydantoin. Measurement of the 5,5-dimethylhydantoin provides a quantitative assessment of the amount of Bladex and/or its metabolites present. This is readily accomplished by gas-liquid chromatography or by thin-layer chromatography. As an example, a procedure for the electron-capture gas chromatographic deter-mination of a water-soluble metabolite derived from Bladex herbicide by conversion to 5,5dimethylhydantoin is described. Following the procedure, 1 ng of the metabolite gives 25 percent full-scale response on the gc recorder chart. Recovery data from experiments run on crops and soil were generally in the 75 to 110 percent range when equal amounts of sample and reference solution in the same concentration range were crops and 0.02 ppm is achieved in soil and water. (Mortland-Battelle) W74-03587

DETERMINATION OF TRICHLORFON (0,0--DIMETHYL (2,2,2-TRICHLORO-1-HYD-ROXYETHYL)PHOSPHONATE) IN FOREST ENVIRONMENTAL SAMPLES, State Univ. Coll., Oswego, N.Y. Lake Ontario En-

vironmental Lab. J. M. Devine.

Journal of Agricultural and Food Chemistry, Vol 21, No 6, p 1095-1098, November/December 1973. 2 fig, 2 tab, 4 ref.

Descriptors: \*Gas chromatography, \*Pesticides, \*Pollutant identification, Vegetation, Soils, Mud, Separation techniques, \*Water analysis, \*Soil analysis, Aqueous solutions, Pesticide residues, Flame photometry, Activated carbon, Stability,

Identifiers: \*Trichlorfon, Environmental samples, Tissue, Cleanup, Storage, Biological samples, Recovery, Sample preparation, Sample preserva-tion, Chromatograms, Twigs.

A gas chromatographic method is described for the determination of trichlorfon (0,0-dimethyl (2,2,2-trichloro-1-hydroxyethyl)phosphonate) various forest environmental samples such as leaves, twigs, forest litter, soil, mud, water, aquatic vegetation, and animal tissues. Trichlorfon residues were removed with chloroform. Animal extracts were processed through hexane-water and water-chloroform partition steps to remove lipid materials. Forest extracts were cleaned up with Nuchar C-190N activated carbon. Determination of trichlorfon was made with a gas chromtograph equipped with a flame photometric detector in the phosphorus mode. Recovery from the vari-ous types of samples averaged 96 percent. The method is senistive to 0.002 ppm for water and 0.05 ppm for all other sample types. (Mortland-Bat-W74\_03588

ELEMENT SPECIFIC GAS CHROMATO-GRAPHIC ANALYSES OF ORGANOCHLORINE PESTICIDES IN THE PRESENCE OF PCB'S BY SELECTIVE CANCELLATION OF INTERFER-ING PEAKS.

igan Dept. of Public Health, Lansing.

G. C. C. Su, and H. A. Price.

Journal of Agricultural and Food Chemistry, Vol 21, No 6, p 1099-1102, November/December 1973. 4 fig, 4 tab, 24 ref.

Descriptors: \*Aroclors, \*Gas chromatography, \*Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, \*Pollutant identifica-

Identifiers: Electrolytic conductivity detector,

Polychlorinated biphenyl interference-free qualitative and quantitive gas chromatographic (gc) analyses of beta-BHC, oxychlordane, hep-(gc) analyses of beta-BHC, oxychlordane, hep-tachlor epoxide, p,p'-DDE, o,p-DDT, p,p'-DDD, p,p'-DDT, and Mirex in the 10-25 ng range have been carried out in the een carried out in the presence of approximately 10 to 20 times their concentrations of Aroclors 1232, 1248, 1254, and 1260 by the use of the Coulson electrolytic conductivity detector in the non-catalytic reductive mode. No modification of the detector system was necessary except to set the detector's reactor temperature at 660 degrees. The results of individual analyses in most instances were within plus or minus 20 percent of the actual value. The operating parameters of the Coulson conductivity detector for gc in the noncatalytic reductive mode are as follows: conductivity bridge voltage, 30 V; conductivity bridge attenuation, 1; furnace (reactor) temperature, 660-840 degrees; transfer block temperature, 250 degrees; hydrogen flow rate through reactor, 40 ml/min; nitrogen flow rate through reactor, 100 ml/min; gas chromatograph column temperature, 200 degrees; sample size, 5 microliters. (Mortland-Battelle) W74-03589

DIBUTYL- AND DI- (2-ETHYLHEXYL)PHTH-ALATE IN FISH, Food and Drug Directorate, Ottawa (Ontario). Food Research Labs. D. T. Williams.

Journal of Agricultural and Food Chemistry, Vol 21, No 6, p 1128-1129, November/December 1973. 1 tab, 10 ref.

Descriptors: \*Freshwater fish, \*Marine fish, Crabs, Clams, Oysters, Shrimp, Separation techniques, Foods, Canada, \*Gas chromatography, \*Pollutant identification.

Identifiers: Biological samples, Sample prepara-tion, \*Dibutylphthalate, di- (2-Ethylhexyl)phtha-late, Gas liquid chromatography, Recovery, GCmass spectrometry, Scallops,

Twenty-one samples of canned seafoods and fish from Canadian lakes and rivers were analyzed by and GLC-mass spectrometry for tylphthalate (DBP) and di- (2-ethylhexyl)phthalate (DEHP). Samples were chopped, macerated manually, and extracted three times by heating with hexane. The hexane solutions were conce trated, extracted with acetonitrile saturated with hexane, and concentrated again. m-Chloroper-benzoic acid and sulfuric acid were added and the solution let stand overnight. After adding water, the solution was extracted with petroleum ether, the extract dried, concentrated, transferred to a silica gel column made up with ethyl ether in petroleum ether, eluted, and the eluate examined petroleum ether, eluted, and the eluate examined by GLC. CLC-mass spectrometry was used for confirmation of phthalate esters at concentrations five times greater than background levels. Recove-

# WATER QUALITY MANAGEMENT AND PROTECTION-Field 05

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ries were 60-65 percent for DBP and 65-70 percent for DEHP. Concentrations found were 0-78 ppb DPB and 0-160 ppb DEHP in the 21 samples. (Little-Battelle) W74-03590

BACTERIAL DECOMPOSITION PROCESSES IN LAKE WINGRA SEDIMENTS DURING

WINTER, Wisconsin Univ., Madison. Dept. of Bacteriology. C. W. Boylen, and T. D. Brock Limnology and Oceanography, Vol 18, No 4, p 628-634, July 1973. 2 fig, 2 tab.

Descriptors: \*Lake sediments, \*Cultures, \*Bac-Descriptors: \*Lake sediments, \*Cultures, \*Bacteria, \*Growth rates, Water temperature, \*Wisconsin, \*Degradation (decomposition), Adaptation, \*Metabolism, Bioassay, Sediments, Radioactivity techniques, Dissolved oxygen, Temperature, Seasonal, Cold resistance, Carbon dioxide, Primary productivity.

Identifiers: \*Lake Wingra (Wis), Incubation, Scintillations of the control of the co

tillation counting, Bacterial physiology.

Samples of sediment were collected from Lake Wingra, Wisconsin, from January 19 - July 21, 1972, for use in tests to determine whether bacteria in sediments adapted to low temperatures. Samples were collected with a type R sampler, transferred to collection bottles, and kept at 4 C until use. DO and air, water, and sediment temperatures were recorded at the time of sampling. Glucose incorporation was measured by adding C. 14-labeled material to sediment suspensions and incubating in the dark at temperatures of 0 to 50C. Release of C-14-labeled CO2 was measured by trapping it in scintillation fluid. Growth rates were studied by preparing cultures of the sediment bac-teria for incubation at 4,115, and 25C. The results show that viable counts of bacteria were always higher at 25C that 4C, although the temperature of the sediments remained below 4C for over 3 months. All of the organisms isolated and initia cultivated at 4C grew better at 25C; no obligately psychrophilic bacteria were found. Isotope studies to measure the temperature optima of the resident bacterial flora showed that the optimum tempera-ture for incorporation of C-14-glucose into cell material and conversion of C-14-glucose into C-14-CO2 remained at 25C or greater all winter. A true psychrophilic flora does not develop in these sediin winter, and bacterial decomposition processes occur at a much slower rate in winter than in summer. (Little-Battelle) W74-03592

SYNCHRONOUS CULTURES OF BACILLUS SUBTILLE OBTAINED BY FILTRATION WITH GLASS FIBER FILTERS, National Inst. for Medical Research, London (En-

glanu). M. G. Sargent. Journal of Bacteriology, Vol 116, No 2, p 736-740, November 1973. 3 fig, 2 tab, 16 ref.

Descriptors: \*Filters, \*Bacteria, \*Cultures, Cytological studies, Radioactivity techniques, Size, Growth rates, Proteins, Synthesis, Filteration, Spores, Germination, Distribution, Separation techniques. Identifiers: \*Bacillus subtilis, Synchronous cul-

tures, DNA, Coulter counter, Culture media

A simple method of potentially wide applicability for obtaining synchronous cultures of Bacillus subtilis based on size selection is described. Using glass fiber filters, a population (about 1 to 2 per-cent of the parent population) can be obtained sub-stantially enriched for small cells which grow synchronously. A method for rapidly concentrating dilute suspensions of cells is described. Batches of cells (500 ml) at an optical density (OD) of 1.5 to 2.0 (540 nm) were placed in the filtration unit, and the water pump was started. For most purposes the negative pressure was increased

steadily from 0 to about 15 cm of mercury. By changing the filters once, 1 liter of selected cells (yield about 4 percent) could be obtained in 2 min. Further selection and concentration was achieved by passing the filtrate through another pad of glass fiber filters, a collection filter (GF/C, 5.5 cm) (mounted in a smaller apparatus), at a negative pressure of 30 to 40 cm of mercury. The increase in retentiveness at high negative pressures pro-vides an especially useful method of combining a selection and concentration step. Cells obtained by filtration in this way grow synchronously. (Mort-W74-03599

GLUCOSE AND PYRUVATE METABOLISM OF SPIROCHAETA LITORALIS, AN ANAEROBIC

Massachusetts Univ., Amherst. Dept. of Microbiology. For primary bibliographic entry see Field 05B. W74-03600

INVESTIGATION OF THE ENERGETICS OF METHANE-UTILIZING BACTERIA IN METHANE- AND OXYGEN-LIMITED CHEMO-STAT CULTURES,

Tokyo Univ. (Japan). Inst. of Applied Microbiolo-

gy. S. Nagai, T. Mori, and S. Aiba. Journal of Applied Chemistry and Biotechnology, Vol 23, No 7, p 549-562, July 1973, 7 fig. 1 tab. 16

Descriptors: \*Methane bacteria, \*Cultures, \*Oxygen, \*Methane, Growth rates, Absorption, Respiration, Dissolved oxygen. Identifiers: \*Chemostat cultures, Dilution rate, Continuous cultures, Aerobacter aerogenes, Azotobacter vinelandii, Saccharomyces cerevisiae, Energetics, Culture media.

A special apparatus was used to establish methane- and oxygen-limited chemostat cultures of a methane-utilizing bacterium, at 30C, pH equals 7.0, respectively. The characteristic feature of this arranagement is a complete absence of direct gassing with both methane and air (oxygen). Instead, two vessels (initial working volume equals 3 1, magnetically stirred) were provided in which fresh medium was saturated separately with methane and oxygen; the medium, saturated with either methane or oxygen, was then charged separately into the culture vessel (working volume equals 1 litre, placed on a magnetic stirrer) using a peristaltic pump. The culture vessel was filled up with the medium after inoculation from the preculture so as to provide a cell mass concentration of nearly 10 mg/l. Although total growth yields with respect to methane and oxygen were hardly affected by dissolved oxygen concentration in the medium, provided dilution rate was kept nearly at 0.1/hr, these values appeared to increase slightly with the increase of dilution rate. Assuming that no metabolites other than carbon dioxide and water were produced during bacterial growth, maintenance coefficients and true growth yields were assessed from specific rates of methane uptake and respiration. These energetic constants, nearly independent of the limiting substrates, either methane or oxygen, were compared with those from published data on facultative and obligate aerobes, including a mixed culture of methane-utilizing bacteria. (Mortland-Battelle) W74-03601

METHYLMERCURY IN ESTUARINE SEDI-

MENTS, Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 05B.

NON-DETERGENT DETERGENT DETERGENT AND NON-DETERGENT PHOSPHORUS IN SEWAGE,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05B.
W74-03606 AND

INSTRUMENTATION FOR WATER POLLU-TION MONITORING, Honeywell, Inc., Fort Washington, Pa. For primary bibliographic entry see Field 05D.

# 5B. Sources of Pollution

PARABIOTIC GROWTH CHARACTERISTICS OF SELECTED SEWAGE BACTERIA, Georgia Inst. of Tech., Atlanta. Environmental Resources Center. For primary bibliographic entry see Field 05C. W74-03203

ANALYSIS OF THE BENTHIC MACROINVER-TEBRATE COMMUNITY STRUCTURE FOR ASSESSMENT OF WATER QUALITY OF DES

MOINES RIVER, Drake Univ., Des Moines, Iowa. For primary bibliographic entry see Field 05C.

SPECIES DIVERSITY OF BENTHIC MACROIN-VERTEBRATES IN THE DES MOINES RIVER.

Drake Univ., Des Moines, Iowa. For primary bibliographic entry see Field 05C. W74-03211

PROCEEDINGS, MISSISSIPPI RESOURCES CONFERENCE, 1973. WATER Mississippi State Univ., State College. Water Resources Research Inst.

Available from the National Technical Informa-tion Service as PB-226 766; \$7.75 in paper copy, \$1.45 in microfiche. Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, Vicksburg, 1973. 108 p.

Descriptors: \*Conferences, \*Water resources, \*Mississippi, \*Information exchange, \*Water resources development, Documentation, Water quality control, Surface waters, Groundwater, Water pollution control, Reviews, Evaluation, Environment of the control of the co vironmental control, Erosion control, Pollution abatement, Watershed management, Estuaries, Gulf of Mexico, Water pollution sources. Identifiers: \*Symposium.

The eighth Mississippi Water Resources Con-ference was held in Vicksburg on April 10-11, 1973, for the purpose of exchanging information pertaining to water resources. For various reasons, some of the papers presented at the conference are not included in this report. However, arrangements have been made so that some of those papers which are not included will later be published as separate bulletins. The 9 papers in-cluded in this report are: Nitrogen, Phosphorus and Other Chemicals in Sediments from Reservoirs in North Mississippi; Sediment Yield Estiates Based on Floodwater Measurements and Samples; Environmental Aspects of Watershed Planning; Response of the Lower Mississippi River to Changes in Valley Slope, Sinuosity and Water Temperature; Mathematical Modeling of Water Quality; Multiple Outlet Selective Withdrawal Technique for Water Quality Prediction of Lake Releases; Monitoring Nutrient Losses from Small Watersheds; Look, No Clarifier; and Treatment of Domestic Sewage at Offshore Locations. (See also W74-03213 thru W74-03221) (Woodard-USGS)

# Group 5B-Sources of Pollution

NITROGEN, PHOSPORUS AND OTHER CHEMICALS IN SEDIMENTS FROM RESER-VOIRS IN NORTH MISSISSIPPI, Mississippi Univ., University.

J. R. McHenry, J. C. Ritchie, and A. C. Gill.
In: Proceedings of 8th Mississippi Water
Resources Conference, April 10-11, 1973, p 1-12,

Descriptors: \*Sediments, \*Reservoirs, \*Chemical analysis, \*Mississippi, \*Pollutant identification, Organic matter, Phosphates, Nitrates, Potassium, Particle size, Clays, Sands, Flood control, Erosion control, Sediment control, Path of pollutants, Fertilizers, Sediment transport.
Identifiers: \*Tallahatchie River basin (Miss),

\*Yazoo River tributary (Miss).

Sediment and soil samples were collected in 1969, 1970, and 1971 from five reservoirs and watersheds in the hill country of northern Mississippi. The watersheds range in size from half a square mile to 1,545 square miles. Four of the watersheds are in the Tallahatchie River basin above Sardis Dam; the fifth is in Tallahatchie County on a tributary of the Yazoo River. Sardis Reservoir was built as a flood control structure. The smaller dams were designed for both flood and sediment control. Sediments were enriched in clay but contained less organic material than the sampled surface soils from the contributing watershed. The enrichment of these sediments with clay reflects both the trap efficiency of the reservoirs for sediments and the selective segrega-tion of eroded particles that occurs in the transport and deposition processes. The larger particles move slower in transport than do the finer particles, and hence are deposited first in the slackwater above the reservoir or in the upper end of the conservation pool (delta area). The lack of enrichment of these sediments in organic material (nitrogen, carbon, oxidizable matter) reflects the relative low organic content of the soils in the hill area of north Mississippi and the large contribution to sediments from gully and other nonsheet erosion processes. (See also W74-0312) (Woodard-W74-03213

SEDIMENT YIELD ESTIMATES BASED ON FLOODWATER MEASUREMENTS AND SAM-PLES.

Agricultural Research Service, Oxford, Miss. Sedimentation Lab. For primary bibliographic entry see Field 02J. W74-03214

ENVIRONMENTAL WATERSHED PLANNING. ASPECTS Soil Conservation Service, Jackson, Miss. For primary bibliographic entry see Field 06G. W74-03215

RESPONSE OF THE LOWER MISSISSIPPI RIVER TO CHANGES IN VALLEY SLOPE, SINUOSITY AND WATER TEMPERATURE, Army Engineer District, Vicksburg, Miss. For primary bibliographic entry see Field 02E. W74-03216

MATHEMATICAL MODELING OF WATER

QUALITY, Army Engineer Waterways Experiment Station, Vicksburg, Miss. D. G. Fontane.

In: Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, p 49-58, 1973. 2 fig, 1 plate, 4 ref, append.

Descriptors: \*Environmental control, \*Water quality control, \*Water pollution control, \*Model studies, \*Water quality, Mathematical models, Analog models, Reviews, Evaluation. Identifiers: Physical models.

Concern with the environment has made it necessary to attempt to assess the environmental impact of proposed water resource projects. Whether the project is a waste discharge into a waterway or a large impoundment, the engineer must try to determine the effect of the project on the physical, chemical, and biological characteristics of the existing water resource system. Generally this determination can best be made through the use of a model to represent the existing system. The model can then be modified by the proposed project and the effect observed over space and time. Three types of models are discussed: a physical model, an analog model, and the mathematical model Mathematical models for water quality parameters are constantly being improved and new models being developed. As new mathematical techniques become available, more complex relationships can be analyzed and the need for simplifying assumptions reduced. (See also W74-03212) (Woodard-USGS)

OUTLET SELECTIVE WITHDRAWAL TECHNIQUE FOR WATER QUALITY PREDICTION OF LAKE RELEASES, Army Engineer Waterways Experiment Station, Vicksburg, Miss. T. L. Gloriod.

In: Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, p 59-73, 1973. 7 fig, 5 plate.

Descriptors: \*Water quality control, \*Streams, \*Flow control, \*Reservoir releases, \*Mississippi, Methodology, Water quality, Water temperature, Stratification, Lakes, Flow control, Flow augmentation, Dams, Water levels. Identifiers: Optional vertical reservoir releases.

The demands on multipurpose reservoir planning, design, and operation for quality releases have played a significant role in evaluating both existing and planned projects in Mississippi. The desire to meet downstream water quality criteria without diminishing the quantity has necessitated research aimed at the development of techniques useful to the project designer and operator in meeting these downstream goals. One technique is selective withdrawal, whereby reservoir outlet ports are located at various levels enabling releases to be taken from one or more of several different strata. These 'multiple choice' outlet releases are evaluated. Generally, downstream water quality goals center about the temperature of the water. However, thermal phenomena in terms of water quality may bring about differences in the concentration of dissolved oxygen, pH, and suspended solids; so much that thermal stratification in reservoirs can be thought of as quality stratification. (See also W74-03212) (Woodard-USGS) W74-03218

MONITORING NUTRIENT LOSSES FROM SMALL WATERSHEDS, Tennessee Valley Authority, Muscle Shoals, Ala. Soils and Fertilizer Research Branch.

V. J. Kilmer, and R. T. Joyce. In: Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, p 75-86, 1973, 2 tab, 18 ref.

Descriptors: \*Water quality, \*Nutrients, \*Fertilizers, \*Small watersheds, \*Southeast U.S., Surface waters, Groundwater, Sediment transport, Sediments, Reviews, Evaluation, Water pollution sources, Path of pollutants.

The southeastern United States is a region where fertilizer use and precipitation are relatively high. During 1972 a total of 10.7 million tons of fertilizer materials were used which included 1.4, 0.9, and 1.2 million tons of N, P205, and K20, respectively. The average annual precipitation ranges between 50-60 inches over most of the region; 40% to 70% of this precipitation is lost as runoff. Evapotranspiration normally exceeds precipitation from early spring to early fall over much of the area. These cteristics would appear to favor the transport of native soil and fertilizer nutrients to surface and groundwater, particularly during the winter and early spring. However, there is little indication that fertilizer nutrients, particularly N, will accumulate in surface or groundwater except where such water remains stagnant or nearly so. Several studies of nutrient transport in watersheds are reviewed and evaluated. (See also W74-03212) (Woodard-USGS) W74-03219

LOOK, NO CLARIFIER, Mississippi Power and Light Co., Vicksburg. For primary bibliographic entry see Field 05F. W74-03220

TREATMENT OF DOMESTIC SEWAGE AT OFFSHORE LOCATIONS, Linfield and Hunter, Inc., Vicksburg, Miss. For primary bibliographic entry see Field 05D. W74-03221

EFFECTS OF WASTE PERCOLATION OF GROUNDWATER IN ALLUVIUM NEAR BARSTOW, CALIFORNIA, Geological Survey, Garden Grove, Calif. For primary bibliographic entry see Field 05E.

FEASIBILITY STUDY OF A SEISMIC REFLEC-TION MONITORING SYSTEM FOR UN-DERGROUND WASTE-MATERIAL INJECTION

Petty-Ray Geophysical Group, San Antonio, Tex. F. J. Barr. Jr.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 207-218, 1973. 10 fig, 9 ref.

Descriptors: \*Waste disposal wells, \*Monitoring, \*Seismic studies, Water pollution control, Path of pollutants, Data collections, Data processing.

An effective method of monitoring the movement and distribution of injected waste materials is needed: In most cases, the acoustical properties of the receiving formation (its density and the velocity of propagation of compressional sound waves) will be changed upon contact with the in-jected waste materials. These changes will subsequently change the reflection coefficient encountered by a vertically traveling sound wave at the receiving formation. This change in acoustical properties suggests the application of modern seismic reflection and data-processing techniques to this monitoring problem. The use of the seismic method on a periodic basis is proposed to detect changes of acoustical properties in the receiving formation and surrounding formations to monitor effectively the movement and position of the waste materials. The assumed seismic field system for this monitoring system includes the following components: (1) permanent arrays of velocity geophones buried a small distance below the sur-face of the earth, (2) a multichannel digital recording system of the instantaneous-floating-point type, (3) truck-mounted seismic surface energy sources, and (4) the use of digital seismic data-processing center. (See also W74-03222) (Knapp-USGS) W74-03230

RADIOACTIVE- AND CHEMICAL-WASTE TRANSPORT IN GROUNDWATER AT NATIONAL REACTOR TESTING STATION, IDAHO: 20-YEAR CASE HISTORY AND DIGITAL MODEL, Geological Survey, Idaho Falls, Idaho.
J. B. Robertson, and J. T. Barraclough.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Sources of Pollution-Group 5B

In: Underground Waste Management and Artificial Recharge, Vol 1, p 291-322. 1973. 16 fig, 2 tab,

Descriptors: \*Radioactive wastes, \*Groundwater movement, \*Waste disposal wells, \*Path of pollu-tants, \*Idaho, Tritium, Chlorides, Strontium radioisotopes, Cesium, Cobalt radioisotopes, Ion exchange, Alluvium, Dispersion, Simulation analysis, Mathematical models.

Industrial and low-level radioactive liquid wastes at the National Reactor Testing Station (NRTS) in Idaho have been discharged to the Snake River Plain aquifer since 1952. The waste discharge to the aquifer at NRTS, which has averaged about 1 the aquier at NATS, which has averaged about billion gal per year, contained small quantities of tritium, Sr-90, Cs-137, Co-60, chloride, hexavalent chromium, various acids and bases, and heat. Tritium and chloride have dispersed over a 15-sqmi area of the aquifer in low but detectable con-centrations and have migrated as much as 5 mi downgradient from discharge points. The movement of cationic waste solutes, particularly Sr-90 and Cs-137, has been significantly retarded owing to sorption phenomena, principally ion exchange. Sr-90 has migrated only about 1.5 mi from a discharge well. A digital model includes the effects discharge well. A digital model includes the effects of convective transport, flow divergence, two-dimensional hydraulic dispersion, radioactive decay, and reversible sorption. The 20-year transport and distribution history of waste chloride and tritium has been successfully simulated by the model. (See also W74-03222) (Knapp-USGS) W74-03233

MODIFICATION ARTIFICIALLY RECHARGED WATER IN SWITZERLAND, H. Schmassmann.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 323-334. 1973. 9 fig, 1 tab.

Descriptors: \*Artificial recharge, \*Waste water disposal, Water treatment, Waste treatment, Oxygen demand, Percolation, Water purification, Gravels, Alluvium, Groundwater movement. Identifiers: \*Switzerland.

In some artificial-recharge plants in Switzerland, Pleistocene gravels are artificially replenished by polluted river water and recharge capacities are from 1 to 25 million gal/day. The retention time of the individual water particles is considerably varied and depends on hydraulic dispersion. The oxygen content of the artificially recharged groundwaters depends on the oxygen concentration and the highest production of the second of the content of the second of the content of the second of th tion and on the biochemical oxygen demand of the raw water. There are no significant differences in oxygen balance between percolative and direct infiltration, probably because significant quantities of oxygen are no longer present after the first percolative seepage of polluted raw water in an un-saturated zone above the water table. After infiltration, aerobic decomposition of organic matter and elimination of bacteria generally require short flow times. High oxygen content and low biochemical oxygen demand of the raw water, together with long retention times, are the most important factors in modification of river water to a wholesome drinking water by artificial recharge. (See also W74-03222) (Knapp-USGS) W74-03234

HYDRODYNAMICS OF MOUNT SIMON SAND-STONE, OHIO AND ADJOINING AREAS, Geological Survey, Columbus, Ohio M. J. Clifford.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 349-356, 1973. 6 fig, 2 tab, 5

Descriptors: \*Path of pollutants, \*Waste disposal wells, \*Hydrogeology, \*Ohio, Underground waste disposal, Injection wells, \*Sandstones, Aquifer characteristics, Velocity.
Identifiers: Mount Simon Sandstone.

The Mount Simon Sandstone (Cambrian), the most favorable stratum for waste injection in Ohio, presently accepts about 250 million gal of industrial waste per year. The potentiometric-surface map mirrors the structural configuration; highest values are in the deeper part of the Ap-palachian basin and lowest values are on the Indi-ana-Ohio platform. Flow direction in central Ohio is west or northwest. Head difference is 2-7 ft. Velocities are less than 6 inches per year. These calculations show that transport of injected fluids by hydrodynamic flow is not presently a serious hazard in Ohio. (See also W74-03222) (Knapp-W74-03235

PETENTION OF DISSOLVED CONSTITUENTS OF WASTE BY GEOLOGIC MEMBRANES, Geological Survey, Menlo Park, Calif. Y. K. Kharaka.

In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 420-435, 1973. 6 fig, 1 tab,

Descriptors: \*Groundwater movement, \*Path of pollutants, "Membrane processes, "Ion transport, Ion exchange, Mass transfer, Clays, Shales, Clay minerals, Waste disposal wells, Underground waste disposal.

Clays and shales are semipermeable membranes, cays and snates are sempermeason memoranes, retarding by varying degrees the passage of the dissolved species with respect to water. The rela-tive retardation by geologic membranes of cations and anions generally present in waste solutions was investigated using a high-pressure and high-temperature filtration cell. The solutions were temperature intration cell. In a solutions were forced with varied hydraulic gradients through different clays and a disaggregated shale subjected to compaction pressures up to 10,000 psi and to temperatures from 20-70 deg C. The membrane efficiencies increased with increase of exchange capacity and with decrease in concentration of the input solution. The efficiency of a given mem-brane increased with increasing compaction pres-sure but decreased at higher hydraulic gradients. The degree of retardation is different for different dissolved species. The retardation sequences for monovalent and divalent cations were generally as follows: Li< Na< NH3< K< Rb< Cs and Mg< Ca< Sr< Ba. Anion sequence was: HCO3< I<B< SO4< Cl< Br. (See also W74-03222) (Knapp-USGS) W74-03228

HYDROGEOLOGIC STUDIES AT A SUBSURFACE RADIOACTIVE-WASTE-MANAGEMENT SITE IN WEST-CENTRAL CANADA, Waterloo Univ. (Ontario). Dept. of Earth

Sciences. For primary bibliographic entry see Field 05E. W74-03239

GEOHYDROLOGY OF BURIED TRIASSIC BASIN AT SAVANNAH RIVER PLANT, SOUTH CAROLINA,

Du Pont De Nemours (E.I.) and Co., Aiken, S.C.

Savannah River Lab.
For primary bibliographic entry see Field 05E.
W74-03241

ROLE OF BACTERIA IN DECOMPOSITION OF INJECTED LIQUID WASTE AT WILMINGTON, NORTH CAROLINA, North Carolina State Univ., Raleigh. Dept. of

Microbiology.

An DiTommaso, and G. H. Elkan. In: Underground Waste Management and Artificial Recharge, Vol 1, p 585-599, 1973. 4 fig, 5 tab, 4

Descriptors: \*Underground waste disposal, \*Waste disposal wells, \*Biodegradation, \*Bacteria, Monitoring, Industrial wastes, Path of pollu-

tants, Injection wells, \*North Carolina, Liquid

In 1968, Hercules Chemical, Inc., Wilmington, North Carolina, began injecting organic waste through wells into a saline disposal zone at depths of 850 to 1,000 ft. The waste, which is a byproduct of dimethylterephthalate used in the production of synthetic fiber, is composed of water contain synthetic liber, is composed of water containing approximately 15,000 ppm of acetic acid, 5,000 ppm of formic acid, and 500 ppm of methanol, with a pH of about 4.0. The movement and comosition of the transformed waste are monitored by a network of 14 observation wells. The microorganisms in the unpolluted aquifer were isolated and identified. Genera include Agrobacterium, Pseudomonas, Bacillus, Arthobacter, Aerobacter, Corynebacter, and Staphylococcus. Appearance of the waste front at monitoring wells accompanied by a rapid increase in the bacterial population. These bacteria utilized the waste as a source of carbon and energy while receiving their nitrogen from the groundwater. The aquifer supplied various tract elements which the organisms need for growth. Bacteria in the aquifer have the capability for causing decomposition, but cannot decompose the waste at the rate at which it is being injected. (See also W74-03222) (Knapp-USGS) W74-03246

HISTORY OF A TWO-WELL INDUSTRIAL--WASTE DISPOSAL SYSTEM, Bureau of Mines, Bartlesville, Okla. Bartlesville

Energy Research Center.
For primary bibliographic entry see Field 05E.
W74-03247

SODIUM/POTASSIUM RATIO IN WATER OF THE DON RIVER (SOOTNOSHENIYE NATRIYA I KALIYA V VODE R. DONA), Institut, Novocherkassk (USSR).

G. S. Konovalov, V. I. Koreneva, and A. M.

Klepeshnev.

In: Formirovaniye khimicheskogo sostava poverkhnostnykh vod i metody ikh analiza: Gidrokhimicheskiye Materialy, Vol 57, p 22-29, 1973. 2 fig, 2 tab, 8 ref.

Descriptors: \*Water chemistry, \*Sodium, \*Potassium, Rivers, Tributaries, Inorganic compounds, Water analysis, Water sampling, Variability. Identifiers: \*USSR (Don River), \*Mineralization.

Temporal changes in sodium and potassium concentrations in river water were investigated in the Don River at Aksay in 10-day determinations of these elements from April 3, 1969 through June 30, 1970. Variations in sodium concentration in Don River water agree well with changes in total mineralization of water. No clear relation is observed between potassium concentration and total mineralization of river water. As a result of the influence of tributaries and highly mineralized groundwater, sodium in Don River water at Aksay during low flows is one of the predominant cations. Temporal variability of potassium concentration in Don River water at Aksay is small. The slight increase in pottassium concentration during the flood of April 1970 was caused by leaching of potassium-bearing organic residues from the soil surface by melt waters. The sodium/potassium ratio in Don River water varies widely, between 14 and 47.5. Variations in this value agree largely changes in sodium concentration in time. (Josef-son-USGS) W74-03253

DISTRIBUTION PATTERNS OF ORGANIC MATTER IN RIVER WATERS OF THE WOODED TUNDRA ZONE (ZAKONOMER-RASPREDELENIVA

# Group 5B—Sources of Pollution

RECHNYKH VOD LESOTUNDROVOY ZONY), Gidrokhimicheskii Institut, Novocherkasa For primary bibliographic entry see Field 02K.

W74-03255

CHANGES IN CHEMISTRY OF NATURAL WATERS OF CULTIVATED LANDS (IZ-MENENIYA KHIMIZMA PRIRODNYKH VOD KUL'TURNYKH LANDSHAFTOV),

Akademiya Nauk SSSR, Moscow. Institut Geografii.

G. S. Shil'krot.

Akademiya Nauk SSSR Izvestiya, Seriya Geograficheskaya, No 3, p 42-50, May-June 1973. 2 tab, 27 ref.

Descriptors: \*Water pollution, \*Water chemistry, Runoff, \*Leaching, \*Cultivated lands, Inorganic compounds, Nutrients, Surface waters, Surface runoff, Agricultural runoff, Overland flow, Groundwater, Base flow, Precipitation (At-mospheric), Wastes. Identifiers: USSR.

Effects of man on changes in chemical composition of natural waters and on increased concentrations of phosphorus and nitrogen in surface waters and groundwater are discussed. Participating in these processes are atmospheric precipitation, domestic and industrial waste waters, and agricultural runoff. Effects of domestic and industrial wastes are analyzed together with the changing role of soils in the formation of the composition of natural waters during intensive introduction of chemical processes into agriculture. (Josefson-USGS) W74-03257

CUMULATION OF RADIOACTIVE SUB-STANCE IN DAM RESERVOIRS, Instytut Gospodarki Kommunalnej, Chorzow (Po-

land). Samodzielna Pracowniz Radioekologii. J. Kwapulinski.

Acta Hydrobiologica. Cracow, Vol 15, No 2, p 215-225, 1973. 5 fig, 3 tab, 12 ref.

\*Radioisotopes, \*Bentuos, \*Zooplankton, \*Periphyton, \*Phytoplankton, \*Zooplankton, \*Bottom sediments, Aquatic plants, \*Bioindicators, Radioactive wastes, Absorption, Water pollution effects, Reservoirs, Adsorption, Radioac-

tivity.
Identifiers: \*Poland, Biological magnification, Bioaccumulation, Macroinvertebrates.

Benthos, periphyton, phytoplankton, zooplankton, bottom sediment, and higher plant samples were obtained from one rheolimnic and two limnic reservoirs to investigate the accumulation of radioisotopes in the various components. Three accumulation values were calculated for sediments and periphyton by dividing sample concentration by (1) specific water concentration or (2) by the mean concentration for water, and (3) by dividing mean sample concentration by mean water concentration. Values for other organisms were obtained using specific sample values and mean water values. The sediments accumulated radioisotopes 1,600 to 9,500 times depending on the type of sediment and hydrologic conditions. Periphyton accumulations ranged from 100 to 98,000 times. Other accumulations were: benthos, 5,900-12,000 times; zooplankton, 4,300-7,400 times; phytoplankton, 7,200-13,000 times; and times; phytoplankton, aquatic plants, 8,700-40,000 times. It is concluded that because of the large uptake abilities of the sediments and organisms, self-purification processes are active in the reservoirs except in the event of turbulence when recontamination occurs. Periphyton should be useful as bioindicators of beta radioactivity contamination and also provide useful information on previous contamination levels. (Little-Battelle) W74-03272

NITROGEN FIXATION BY THE UNICELLU-LAR BLUE-GREEN ALGA APHANOTHECE, Central Rice Research Inst., Cuttack (India). Dept. of Blue-Green Algae.

For primary bibliographic entry see Field 05C.

GERMANIUM INCORPORATION INTO THE SILICA OF DIATOM CELL WALLS, California Univ., San Diego, La Jolla. For primary bibliographic entry see Field 05C. W74-03280

BIODEGRADATION OF UREA IN RIVER WATERS UNDER CONTROLLED LABORATO-RY CONDITIONS.

Laboratory of the Government Chemist, London

W. H. Evans, E. J. David, and S. J. Patterson. Water Research Vol 7, No 7, p 975-985, July 1973.

Descriptors: \*Ureas, \*Biodegradation, \*Laboratory tests, Rivers, Ammonia, Water temperature, Water analysis, Chemical analysis, Nitrites, Nitrates, Hydrogen ion concentration, Suspended solids, Aerobic conditions, Anaerobic conditions, Nitrification, Chemical reactions, Nitrogen cycle. Identifiers: \*Natural waters, Degradation rates, Degradation products.

The biodegradation of urea in river waters has been evaluated under laboratory conditions. Urea will degrade to ammonia at a rate depending on the bacterial state of the river water and on the water temperature. Under normal conditions no breakdown may be expected to occur at temperatures below 8C for 14 days contact. In river waters with a high suspended solids content, simulating extreme winter river conditions, a maximum break-down of 3-6 percent daily of the original urea levels was found for temperature not exceeding 8C during the first 7 days contact. (Holoman-Battelle) W74-03287

VIRUS REMOVAL IN HAWAIIAN SOILS, Hawaii Univ., Honolulu. For primary bibliographic entry see Field 05F. W74-03293

DISPERSION IN HYDROLOGIC AND COASTAL ENVIRONMENTS,
California Inst. of Tech., Pasadena. W. M. Keck
Lab. of Hydraulics and Water Resources.

N. H. Brooks.

Copy available from GPO Sup Doc as EP1.23:660-73-010, \$1.55; microfiche from NTIS as PB-226 890, \$1.45. Environmental Protection Agency, Ecological Research Series, Report EPA-660/3-73-010, August 1973. 136 p, 37 fig, 132 ref. EPA Pro-ject 16070 DGY.

Descriptors: \*Jets, Stratified flow, Reservoirs, Withdrawal, \*Turbulent flow, Mixing, Diffusion, Abstracts, \*Outlets, Outfall sewers, Thermal polution, Waste dilution, Bibliographies, \*Dispersion, Coasts, \*Path of pollutants, Water pollution

Identifiers: Buoyant jets.

Results are summarized of a five-vear laboratory research project on various flow phenomena of importance to transport and dispersion of pollutants in hydrologic and coastal environments. The results are useful in two general ways: first, to facilitate the prediction of ambient water quality from effluent characteristics in various water environments; and secondly, to provide the basis for design of systems (like outfalls) required to meet ambient water quality requirements. results for buoyant jets may be used for the design of waste-water outfalls in oceans, reservoirs, lakes, and large estuaries. Particular emphasis is given to line sources (or slot jets) which represent

long multiple-outlet diffusers, which are necessary for all large discharges to get high dilutions. For reservoirs which are density stratified, the results include formulations for prediction of selective withdrawal, and a simulation procedure for predicting reservoir mixing by systems which pump water from one level to the other. For applications to rivers and estuaries, laboratory flume experiments were made to measure transverse mixing of buoyant or heavy tracer flows, as well as for neutral-density flows. Abstracts of all publications and reports resulting from the project are given as an appendix W74-03327 endix to the report. (EPA)

CHEMISTRY OF ORGANOMERCURIALS IN

AQUATIC SYSTEMS, Environmental Protection Agency, Athens, Ga. Southeast Environmental Research Lab. G. L. Baughman, J. A. Gordon, N. L. Wolfe, and

G. L. Baugman, J. A. Gordon, N. L. Wolfe, and R. G. Zepp. Copy available from GPO Sup Doc as EP1.23:660-73-012, \$1.30; microfiche from NTIS as PB-226 889, \$1.45. Environmental Protection Agency, Ecological Research Series, Report EPA-660/3-73-012, September 1973. 97 p, 20 fig, 16 tab, 102 ref. EPA Project 310301 QQG.

Descriptors: \*Heavy metals, \*Hydrolysis, \*Kinetics, Metal organic pesticides, Chemical degradation, Aqueous solutions, Water chemistry, Evaporation, Air-water interfaces, \*Mercury, Water pollution sources.
Identifiers: \*Photolysis,

Identifiers: \*Photolysis, \*Organomercury, Photodegradation, Complex formation, Methylmercury, Phenylmercury, Dimethylmercury. Diphenylmercury,

Kinetics in water of some chemical and photochemical reactions postulated as key transformations in the environmental mercury cycle were investigated. Decomposition of dimethylmercury (DMM) and diphenylmercury (DPM) by acids and mercuric salts was shown to be pH dependent and too slow to be significant under most environmental conditions. Degradation of organomercuric salts by acid is even slower. Theoretical evidence indicates that loss of elemental mercury or DMM at the air-water interface can be important in turbulent systems. Dimethylmercury, methylmercuric chloride, methylmercuric hydroxide, and methylmercuric ion were not decomposed by sunlight, but phenylmercury and sulfur-bonded methylmercuric species were readily decomposed to inorganic mercury. Detailed equilibrium calcu-lations indicate that the sulfur-bonded methylmercuric species are the predominant species in natural waters. Quantum yields for these reactions are presented along with a technique for calculating sunlight photolysis rates from laboratory data. A review is included of the chemical literature concerning the kinetics of chemical and photochemidecomposition of organomercurials. (Baughman-EPA) W74-03328

ENRICHMENT OF MARSH HABITATS WITH ORGANIC WASTES, Louisiana Water Resources Research Inst., Baton

For primary bibliographic entry see Field 05D.

74-03337

THE EFFECTS OF SURFACE IRRIGATION WITH DAIRY MANURE SLURRIES ON THE QUALITY OF GROUNDWATER AND SURFACE RUNOFF, Tennessee Univ., Knoxville. Dept. of Agricultural

Engineering. J. C. Barker.

Available from the National Technical Informa-Tion Service as PB-226 917, \$8.75 in paper copy, \$1.45 in microfiche. Ph.D. Thesis, June 1973, 99 p, 12 fig. 10 tab, 52 ref, 2 append. OWRR A-021-TENN (2), 14-31-0001-3243. Descriptors: \*Water quality, Agriculture, \*Irrigation, Nitrates, Groundwater, "Farm wastes, Feedlots, "Tennessee, Land use, Water pollution sources, Lagoons, Infiltration, Water reuse,

Identifiers: \*Dairy waste management, \*Slurry irrigation, Hydraulic transport (Wastes), Manure pumps.

An experimental manure slurry irrigation system was established at the University of Tennessee, Knoxville Cherokee Dairy to receive in a large holding tank, the rainfall runoff, wastewater, and most of the manure from the 125-cow milking herd. About 5.5 tons of dry manure per acre per month was applied by slurry irrigation to a 4-acre test pasture area with groundwells and runoff col-lecting facilities. Solids accumulation on the ground presented no problems. The quality of surface runoff samples from the test area varied greatly with runoff volume; however, the parameter concentrations were usually within those specified by the Federal Water Pollution Control Administration for raw surface water sources for public supplies. Manure slurry apparently infiltrated into the shallow groundwater on the downgrade side of the manure-saturated area. The system performed satisfactorily and has been durable. Optimum performance of the system requires careful management to continuously maintain storage capacity for lot runoff while con-trolling surface runoff of irrigated slurry. The slurry irrigation system offers possibilities for im-proved efficiency in dairy manure management while creating a minimum of pollution problems. (See also W72-07818) (Sewell-Tennessee) W74-03339

EFFECTS OF PARTICLE SIZE AND WAVE STATE ON GRAIN DISPERSION, Chicago Univ., Ill. Dept. of Geophysical Sciences. For primary bibliographic entry see Field 02L. W74-03344

PRELIMINARY REPORT ON THE HYDROG-RAPHY OF THE PENSACOLA BAY ESTUARY. FLORIDA.

Florida Dept. of Natural Resources, St. Petersburg. Marine Research Lab. For primary bibliographic entry see Field 02L. W74-03347

MATHEMATICAL SIMULATION OF TIDAL TIME-AVERAGES OF SALINITY VELOCITY PROFILES IN ESTUARIES, Massachusetts Inst. of Tech., Cambridge For primary bibliographic entry see Field 02L. W74-03348

HAZARDS OF WASTE DISPOSAL IN GROUND-WATER BASINS, Geological Survey, Sacramento, Calif.
For primary inbliographic entry see Field 05E.

W74-03357

REMOTE SENSING IN THE STUDY OF COASTAL PROCESSES. Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 07B. W74-03373

POTENTIAL OF AN ERODING URBAN SOIL FOR THE PHOSPHORUS ENRICHMENT OF STREAMS: I. EVALUATION OF METHODS, Massey Univ., Palmerston North (New Zealand). J. C. Ryden, J. K. Syers, and R. F. Harris. J Environ Qual. Vol 1, No 4, p 430-434, 1972. Illus. Identifiers: Desorption, \*Fertilizers, Methods, \*Phosphorus, \*Soil erosion, Sorption, Streams, \*Urban development. Eroding non-calcareous and calcareous soil horizons sampled on an urban development site sorbed a varying proportion of added inorganic phosphate (P). At an added P level of 600 micrograms P/1 (30 micrograms P/g soil in 50 ml of 0.1 M NaCl), the Al horizon showed a net release of P whereas the B1 and 3Cl horizons sorbed 96 and 53% of the added P, respectively. The appreciable release of P from the Al horizon is attributed to the resence of a small amount of a moderately soluble P fertilizer-soil reaction product. In simulated stream systems employing a solution/soil ratio of 1000:1, initial added P concentrations of 0 and 50 micrograms P/1, and adequate aeration, approximately 50% of the final P concentration was attained in less than 3 hr. Release of P (50 micro-grams P/1) from the Al horizon was independent of the initial P concentration. The B1 horizon released 10 micrograms P/1, twice that released by the 3Cl horizon, whereas these 2 horizons sorbed approximately equal amounts of added P. In a system containing a 1:1 mixture of the Al and Bl horizons, the amount of P released by the Al in the presence or absence of added P was greater than that capable of being sorbed by the Bl horizon. Initial P concentrations were shown to be more important than the solution/soil ratio in determining e extent of uptake and release of P by the soil horizons. The use of a 400:1 solution/soil ratio and low levels of added P (0-200 micrograms P/1) provides a useful basis for developing a routine test for evaluating the potential of eroding soils for the P enrichment of streams.--Copyright 1973, Biological Abstracts, Inc. W74-03438

WATER MOVEMENTS IN SHALLOW COASTAL BAYS AND ESTUARIES, Miami Univ., Fla. Sea Grant Institutional Pro-

gram. For primary bibliographic entry see Field 02L. W74-03442

EFFECT OF PHOSPHATE AND CHLORIDE SALTS ON AMMONIFICATION IN WATER-LOGGED SOILS, Wisconsin Univ., Madison. Dept. of Soil Science.

For primary bibliographic entry see Field 02G. W74-03445

ORGANIC COMPOUNDS IN SOIL WATER OF SOME ULTISOLS OF THE ATLANTIC COASTAL PLAIN, North Carolina State Univ., Raleigh. Dept. of Soil

Science. For primary bibliographic entry see Field 02G. W74-03494

DISTRIBUTION AND CHARACTERISTICS OF ORGANIC MATTER IN RIVER WATERS OF THE TUNDRA ZONE (RASPREDELENIYE I OSOBENNOSTI ORGANICHESKIKH VESHCHESTV DROVOY ZONY), Gidrokhimicheskii RECHNYKH Institut. Novocherkassk (USSR).

For primary bibliographic entry see Field 02K. W74-03534

TECHNIQUES IN FORECASTING CONTENT OF ORGANIC AND BIOGENIC SUBSTANCES IN WATER OF EXISTING AND PROPOSED WATER BODIES (K METODIKE PROGNOZIROVANIYA SODERZHANIYA OR-GANICHESKIKH I BIOGENNYKH
VESHCHESTV V VODE SUSHCHESTVUYUSHCHIKH I PROYEKTIR UYEMYKH VODOYEMOV), Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.

For primary bibliographic entry see Field 02H. W74-03535

MATHEMATICAL MODELING OF EUTROPHI-CATION OF LARGE LAKES, Manhattan Coll., Bronx, N.Y. Environmental En-

gineering and Science Program.
For primary bibliographic entry see Field 05C. W74-03537

NITRATE AND NITRITE IN THE SURFACE WATERS OF TWO DELAWARE SALT MARSHES.

Delaware Univ., Newark. Dept. of Biological Sciences.

D. Aurand, and F. C. Daiber.

sapeake Science, Vol 14, No 2, p 106-111, 1973. 4 fig, 16 ref.

Descriptors: \*Nitrates, \*Nitrites, \*Salt marshes, \*Delaware, Salinity, Tidal effects, Productivity, Nitrification, Aquatic plants, Ditches, Nutrients, Estuaries, Nitrogen, Phosphorus, Dikes Identifiers: \*Delaware Bay, Murderkill Marsh (Dela.). Canary Creek Marsh (Dela.).

Data concerning nitrogen compounds in salt marsh waters are important in view of the critical role of the salt marsh in estuarine and coastal ecosystems. Distribution of nitrate and nitrite in two Delaware salt marshes was studied from July 1966 through December 1967. Canary Creek Marsh, located near the mouth of Delaware Bay, was characterized by high salinity, low nitrate water. The Murderkill Marsh, in central Delaware, was characterized by low salinity, high nitrate water. Man-made control structures in the Murderkill Marsh inhibited free tidal exchange and modified the distribution of nitrate and nitrite. The following parameters were measured at each station: nitrate, nitrite, pH, salinity, water temperature, air temperature, and weather. The tendency was for salinity stabilization and lack of exchange with increasing level of control, culminating in the high land limited limited in the high land limited limite level impoundment situation. Interesting patterns in the tidal distribution of nitrate were seen in both areas. In Murderkill River, the seasonal pattern was similar, but with only a short summer period of low nitrate levels. This study suggests that ditching and control structures in marshland areas can have inhibitory effects on the nutrient exchange with the estuarine community. (Jones-Wiscon W74-03538

HEAVY METALS IN THE SEDIMENTS OF THE DANUBE, EMS, WESER AND ELBE RIVERS IN WEST GERMANY, (IN GERMAN).

Heidelberg Univ. (West Germany). Laboratorium fuer Sedimentforschung. K. Banat, U. Foerstner, and G. Mueller. Naturwissenschaften. Vol 59, No 12, p 525-528,

1972. Illus. (English summary). Identifiers: Cadium, Danube River, Elbe River,

Ems River, \*Heavy metals, Lead, Mercury, Rivers, \*Sediments (Clay), Weser, \*West Ger-

The pollution with heavy metals of the clay fraction of sediments in major rivers in the Federal Republic of Germany was investigated. Compared to the average contents in argillaceous sedimentary rocks, the elements Cd, Hg, and Pb, which are known to possess high toxicity, were found to be enriched by a factor of up to 300, 50 and 30, respectively.—Copyright 1973, Biological Ab-stracts, Inc.

ANALYSIS OF TRACE ORGANIC COM-POUNDS IN NEW ENGLAND RIVERS, Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05A.
W74-03553

# Group 5B-Sources of Pollution

RETWEEN BIOLOGICAL. DECDESSIONS OCEANOGRAPHIC MEASUREMENTS IN THE EASTERN TROPICAL PACIFIC AND THEIR SIGNIFICANCE TO ECOLOGICAL EFFICIEN-

California Univ., San Diego, La Jolla. Inst. of Marine Resources.

M. Blackburn.

Limnology and Oceanography, Vol 18, No 4, p 552-563, July 1973. 1 fig, 3 tab, 10 ref.

Descriptors: \*Pacific Ocean, \*Standing crops, \*Primary productivity, \*Regression analysis, \*Biological properties, Tropical regions, Zooplankton, Temporal distribution, Spatial dis-tribution, Latitudinal studies, Ecological distribution, Statistical methods, Chlorophyll, Seasonal, Organic matter, Trophic level, Crustaceans, Nekton, Measurement, Oceanography.

Identifiers: Chlorophyll a, Regression coefficients. Marine environment.

Simple regressions of various standing stocks on Simple regressions of various standing stocks on each other and on primary productivity were com-pared by covariance analysis for different seasons, latitudes, and longitudes in the eastern tropical Pacific. The stock of zooplankton varies significantly with that of chlorophyll a to a power less than 1.0 in all seasons and areas, and it is shown that a similar relation probably exists between the corresponding rates of daily produc-tion. A similar relation holds in the regression of standing stock of fish-cephalopod micronekton, suitably lagged, on stock of zooplankton. Thus the relative amount of organic matter transferred from one trophic level to another probably decreases with an increase of stock and production at the lower level, so that ecological efficiency is higher in oligotrophic than in eutrophic situations, in tropical oceans. Standing stock of chlorophyll a varies significantly with primary productivity to a power less than 1.0. The stock of crustacean micronekton sometimes varies with the stock of chlorophyll a to a power greater than 1.0, which is interpreted as a feeding aggregation. (Holoman-Battelle) W74-03559

A STUDY OF PLANKTON DYNAMICS AND NUTRIENT CYCLING IN THE CENTRAL GYRE OF THE NORTH PACIFIC OCEAN. California Univ., San Diego, La Jolla. Inst. of

Marine Resources R. W. Eppley, E. H. Renger, E. L. Venrick, and M. M. Mullin.

Limnology and Oceanography, Vol 18, No 4, p 534-551, July 1973. 5 fig, 6 tab, 73 ref.

Descriptors: \*Cycling nutrients, \*Zooplankton, \*Phytoplankton, \*Growth rates, Limiting factors, \*Pacific Ocean, \*Photosynthesis, \*Mixolimnion, Phosphates, Nitrogen, Biomass, Water pollution, Water analysis, Vitamins, Trace elements, Carbon, Nutrients, Nitrates, Plant growth, Water politics, Nitrates, Plant growth, Nitrates, Nitrates, Nitrates, Nitrates, Nitrates, Nitrates, Nitrat lution, Methodology, Water temperature, Salinity, Sea water, Chemical analysis, Primary productivity, Chlorphyll, Organic matter, Fluorometry.

Identifiers: Excretion rates, Assimilation rates, Data interpretation, Chemical composition, Excretion, Ammonium, Particulate matter, Pheopigments, Chlorophyll a, Adenosine triphosphate, N-15, N-14, Enrichment, Trichodesmium, Oscillatoria.

The dynamics of phytoplankton growth in relation to nutrient concentrations were studied in the sub-tropical central gyre of the North Pacific in November 1971. Rates of excretion of phosphate, ammonium, and urea-N by zooplankton and rates of assimilation of carbon, nitrate, ammonium, and urea-N by phytoplankton were measured. The growth rate of phytoplankton was estimated to be about 0.2-0.3 doublings/day in the 70-80-m mixed layer, apparently limited by concentrations of both nitrogen and phosphate. Only nitrogen concentra-tion was so limiting at a station near the western edge of the California Current. No diel changes in concentrations of ambient nutrients were observed. Urea-nitrogen appears to be an important source of nitrogen for phytoplankton growth in these waters and to be an important excretory product of zooplankton. Concentrations of phosphate and ammonium were extremely low, but turnover times were estimated to be of the order 3-5 days for ammonium and greater than 10 days for urea and phosphate. Biomass of phytoplankton in the mixed layer was also very low, and corresponded approximately to that expected if a laboratory culture were operated as a nitrogen-limited chemostat with a concentration of about 0.48 microgram-atom N/liter in the incoming culture medium and a dilution rate of about 0.13 per day. Physiological differences were noted between the phytoplankton in the mixed layer and that living below the thermocline, as were differences in chemical composition (ratio of C:Chl a and C:N). (Holoman-Battelle) W74-03561

OBSERVATIONS ON THE ECOLOGY AND DIS-TRIBUTION OF THE TURBELLARIAN FAUNA OF THE DANUBE DELTA (BEOBACHTUNGEN UBER DIE OKOLOGIE UND VERBREITUNG DER TURBELLARIENFAUNA IM DONAU-

Bucharest Univ. (Romania). Faculty of Biology. For primary bibliographic entry see Field 05C. W74-03574

PHOTODECOMPOSITION OF P. CHLOROPHENOXYACETIC ACID, California Univ., Davis. Dept. of Environmental

Camorina Chiv., 2015.
Toxicology.
D. G. Crosby, and A. S. Wong.
Journal of Agricultural and Food Chemistry, Vol
21, No 6, p 1049-1052, November/December 1973.

4 fig, 16 ref.

Descriptors: \*Ultraviolet radiation, \*Aqueous solutions, Chemical degradation, Light, Sodium compounds, Pesticides, Water pollution effects, Chemical reactions.

\*Photodecomposition, Identifiers: \*\*Chlorophenoxyacetic acid, Sunlight, Polymeriza-tion, Sodium salt, Chlorinated phenoxyacetic acids, Photolysis, Fate of pollutants.

The purpose was to examine the effect of natural and simulated sunlight (300-450 nm) on dilute aqueous 4-CPA solutions and establish a general mechanism for the environmental photolysis of phenoxy acids. Solutions of 4-CPA (pchlorophenoxyacetic acid) decomposed readily under sunlight or laboratory under sunlight or laboratory ultraviolet light to provide principally p-chlorophenol, phenol, hydroquinone, p-chlorophenyl formate, phenox-yacetic acid, p-hydroxyphenoxyacetic acid, and humic acids. These products represent oxidative removal of the side chain, replacement of the clorine by hydroxyl or by hydrogen, and tion of p-chlorobenzonitrile by irradiation of 4tion of p-chiorobenzontrule by Irradiation of 4-CPA in the presence of cyanide ions substantiated that the corresponding replacement of the ring chlorine by hydroxyl was a photonucleophilic reaction. (Mortland-Battelle) W74-03583

PHOTODECOMPOSITION PHOTODECOMPOSITION OF 2,4,5-TRICHLOROPHENOXYACETIC ACID (2,4,5-

California Univ., Davis. Dept. of Environmental Toxicology.

10xicology, D. G. Crosby, and A. S. Wong. Journal of Agricultural and Food Chemistry, Vol 21, No 6, p 1052-1054, November/December 1973. 3 fig. 2 tab, 15 ref.

Descriptors: \*2 4 5-T, \*Degradation (Decomposition), \*Pollutant identification, Water pollution effects, Aqueous solutions, Ultraviolet radiation, Irradiation, Chromatography, 2 4-D, Light, Chemical reactions.

\*Photodecomposition, Identifiers: Riboflavin, Sunlight, Fate of pollutions, Photoly-

Photodecomposition of the herbicide 2,4,5trichlorophenoxyacetic acid (2,4,5-T) in aqueous solution principally involved cleavage of the ether bond and replacement of the ring chlorines by hydroxyl and by hydrogen. The major products were 2,4,5-trichlorophenol and 2-hydroxy-4,4-dichlorophenoxyacetic acid; 4,6-dichlororesorcinol, 4-chlororesorcinol, 2,5-dichlorophenol, and a dark polymeric product also were isolated. The toxic 2,3,7,8,-tetrachlorodibenzo-p-dioxin was not detected among the photodecomposition products. 2,4,5,-T photolyzed very slowly compared to its 4-chloro and 2,4-dichloro analogs, but the 11-fold increase in photolysis rate caused by sensitization with acetone or riboflavin suggests that sunlight can be an important factor in the environmental degradation of 2,4,5-T. (Mortland-Battelle) W74-03585

GRAZING OF PSEUDOCALANUS MINUTUS ON NATURALLY OCCURING PARTICULATE MATTER.

Dartmouth (Nova Scotia). Bedford Inst. S. A. Poulet.

Limnology and Oceanography, Vol 18, No 4, p 564-573, July 1973. 5 fig, 1 tab, 13 ref.

Descriptors: Grazing, \*Food habits, \*Laboratory tests, Particle size, Selectivity, Browse utilization, Copepods, Organic matter, Water sampling, Plankton nets, Crustaceans, Invertebrates, Marine animals, Food chains, Sea water, Cymnodinium.
Identifiers: \*Particulate matter, \*Pseudocalanus minutus, Bedford Basin, Vertical distribution, Particle concentration, Flagellates, Thalassiosira, Chaetoceros, Food sources, Marine environment.

The quantity and size of particulate matter consumed by Pseudocalanus minutus were studied in seawater samples collected from different depths and from closely spaced stations. The heterogeneity in particle distribution resulted from quantitative and qualitative fluctuations in the particle spectrum, although at times the total concentration was about the same. Pseudocalanus minutus consumed particles between 4 and 100 microns. An electivity index value was more often positive for 25.4-57.0-micron particles. On the average, particles less than 39 microns were more readily eaten than larger particles. The consumption by copepods at different locations was related not to particle size spectrum. Pseudocalanus was able to shift its grazing pressure from small to large particles to compensate for a reduction in density of small particles. (Holoman-Battelle) W74-03593

DISTRIBUTION OF FORAMINIFERA NEAR POLLUTION SOURCES IN CHALEUR BAY, Bedford Inst., Dartmouth (Nova Scotia).

C. T. Schafer. Water, Air, and Soil Pollution, Vol 2, No 2, p 219-233, June 1973, 2 fig. 5 tab, 48 ref.

Descriptors: \*Estuaries, \*Distribution patterns, Water pollution effects, Protozoa, Sewage, Industrial wastes, Sediments, Hydrogen ion concentration, Water temperature, Salinity, Oxygen, Lead, Zinc, Fertilizers, Chlorine, Alkalis (Bases). Powerplants, Pulp wastes, Benthic fauna, Canada, Competition, Dominant organisms, Water quality,

Identifiers: \*Foraminifera, Species diversity.

Benthonic foraminifera samples were collected seasonally near several isolated sources of sewage and (or) industrial effluent in the Restigouche estuary. Distinct biotopes based on species diver-

sity and population density are developed locally especially near Dalhousie peninsula and Belledune Point in response to the effects of effluent discharge. Averaged diversity indices calculated in known polluted areas describe in initially depressed curve that reflects the development of near-abiotic conditions close to the effluent source near-about conditions close to the ertitions source and, at some distance offshore, an anomalously high diversity which may be indicative of a zone near each outfall in which certain components of the effluent generate a temporary favorable artifi-cial environment. The Elphidium incertum/clavatum group usually dominates the living fauna near sewage outfalls and appears to be able to invade and maintain itself on nearshore sedi-ment substrates which have pH values in excess of 6.4. (Mortland-Battelle) W74-03596

DISSIMILATORY REDUCTION OF INOR-GANIC SULFUR BY FACULTATIVELY ANAEROBIC MARINE BACTERIA, Woods Hole Oceanographic Institution, Mass. For primary bibliographic entry see Field 05C.

GLUCOSE AND PYRUVATE METABOLISM OF SPIROCHAETA LITORALIS, AN ANAEROBIC MARINE SPIROCHETE,
Massachusetts Univ., Amherst. Dept. of Microbiology.

R. B. Hespell, and E. Canale-Parola. Journal of Bacteriology, Vol 116, No 2, p 931-937, November 1973. 3 fig, 6 tab, 29 ref.

Descriptors: \*Metabolism, \*Anaerobic bacteria, Marine bacteria, Cytological studies, Sodium chloride, Fermentation, Carbon dioxide, Radioactivity techniques, Enzymes, Chemical reactions, Reduction (Chemical), Hydrolysis, Phosphates, Cultures, Salts.

Identifiers: \*Spirochaeta litoralis, \*Glucose, 
\*Pyruvates, Spirochetes, Acetates, Dissimilation, 
Lysis, Rubredoxin, Buffers, Culture media.

The pathways of glucose and pyruvate metabolism in Spirochaeta litoralis, a free-living, strictly anaerobic marine spirochete, were studied. Addition of 0.2 to 0.4 M NaCl (final concentration) to suspending buffers prevented cell lysis and was necessary for gas evolution from various sub-strates by cell suspensions. The organism fermented glucose mainly to ethanol, acetate, C02, and H2. Determination of radioactivity in products formed from C-14-labeled glucose and assays of enzymatic activities in cell extracts indicated that S. litoralis catabolized glucose via the Embden-Meyerhof pathway. A clostridial-type clastic reaction was utilized by the spirochete to degrade pyruvate to acetyl-coenzyme A, C02, and H2. Formation of acetate from acetyl-coenzyme A was catalyzed by phosphotransacetylase and acetate kinase. Nicotinamide adenine dinucleotide-dependent acetaldehyde and alcohol dehydrogenases converted acetyl-coenzyme A to ethanol. A reversible hydrogenase activity was detected in cell extracts. S. litoralis cell extracts contained a rubredoxin similar in spectral properties to other bacterial rubredoxins. (Mortland-Battelle) W74-03600

METHYLMERCURY IN ESTUARINE SEDI-

MENTS, Florida State Univ., Tallahassee. Dept. of

Oceanography.
A. W. Andren, and R. C. Harriss.
Nature, Vol 245, No 5423, p 256-257, October 5, 1973. 2 fig. 1 tab, 12 ref.

Descriptors: \*Mercury, 8sediments, \*Estuaries, Water pollution effects, Gulf of Mexico, Gas chromatography, Distribution patterns, Organic com-pounds, Fluorescence, Chemical reactions,

Identifiers: \*Methylmercury, Mississippi Delta, Mobile Bay, Everglades, Sample preservation, Flameless atomic fluorescence, Methylation.

A study was conducted to determine the concentration and distribution of methylmercury com-pounds in natural sediments from polluted and unpolluted coastal environments. Surface sediments were collected and analyzed from the Mississippi Delta, Mobile Bay, and the Florida Everglades. All the sediment samples were frozen immediately after collection and returned to the laboratory for the determination of total mercury, methylated mercury and total organic content. The methylmercury concentration varied from less than 0.02 ng/g to 0.19 ng/g, the high value being in the estuarine sediments from Mobile Bay. The most interesting aspect of the data is the fact that the methylmercury content never represents more than 0.07 percent of the total mercury present; the average is 0.03 percent. Measurements of methylmercury with depth in two cores from Mobile Bay were also made. Both cores were reducing except for the upper 4 to 5 cm. It is shown that the methylmercury values decrease with depth to minima of approximately 0.02 ng/g and that the methylmercury concentrations vary from 0.04 percent to 0.006 percent of the total mercury. The results suggest that future toxicological studies should emphasize biochemical mechanisms for synthesis of methylmercury from inorganic mercury species. (Mort-land-Battelle) W74-03602

MERCURY-SELENIAM MARINE MAMMALS, Marine Univ., Wageningen (Netherlands). MERCURY-SELENIUM CORRELATIONS IN

Agricultural Univ., Wageningen (Netherlan Dept. of Toxicology. For primary bibliographic entry see Field 05C. W74-03603

DETERGENT AND NON-DETERGENT PHOSPHORUS IN SEWAGE, Utah Water Research Lab., Logan D. B. Porcella, P. A. Cowan, and E. J.

Middlebrooks. Public Works, Vol 104, No 9, p 126-128, September 1973. 1 fig, 2 tab, 6 ref.

Descriptors: \*Domestic wastes, \*Detergents, Phosphates, "Water quality control, "Nutrient removal, "Sewage effluents, Water pollution sources, Organic matter, Carbon, Nitrogen, Iron, Biochemical oxygen demand, Hydrogen ion concentration, Alkalinity, Conductivity, Flow rates, Suspended solids.

Identifiers: Characterization, Volatile solids. Background levels.

Sewage samples were collected from a suburban community of the City of Logan, Utah, and analyzed to develop basic data on the changes in phosphorus content that might occur as a result of restricting the use of heavy-duty detergents. A baseline sample was collected first, and three weeks later the residents were requested not to use dishwashers and clotheswashers for a period of 48 hours to permit collection of test samples. Flow rates, C, N, P, Fe, BOD, pH, alkalinity, conductivity, suspended solids, and volatile solids were measured for the samples collected during the two periods. During the test period, total phosphorus decreased by 57 percent. The concentration of organic carbon and BOD almost doubled in the test sample while nitrogen remained approximately constant. Iron was relatively low in the raw sewage. Alkalinity, pH, and conductivity were in the range considered normal for raw sewage. The difference in solids concentration corresponds to the increase in organic carbon and BOD indicating that the lack of dilution water from the washers caused a significant increase in concentration in the test sample. It is concluded that additional research is necessary before decisions are made to restrict detergent usage or to remove phosphorus at treatment plants. (Little-Battelle)

W74-03606

HYDRAULIC MODEL TESTS OF ESTUARIAL WASTE DISPERSION. Robert A. Taft Sanitary Engineering Center, Cin-

cinnati, Ohio.
R. L. O'Connell, and C. M. Walter.

R. L. O Connell, and C. M. Walter. Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 89, No SA1, Proceedings Paper 3394, p 51-65, January 1963. 4 fig, 1 tab, 12 ref.

Descriptors: \*California, Bays, \*Estuaries, \*Paths of pollutants, \*Waste disposal, \*Dye dispersion, Salinity, Barriers, Water quality, \*Hydraulic models, Coasts, Outlets, Biochemical oxygen de-

Identifiers: San Francisco Bay.

Hydraulic model studies were made of the waste dispersion characteristics of San Francisco Bay. The effects of several proposed salinity control barriers on these characteristics were investigated. A fluorescent dye tracer, Pontacyl Brilliant Pink 'B' and the G. K. Turner Associates Fluorometer were used. Using the results of the model studies, estimates were made of the effect of existing and future waste loads on the oxygen resources of the Bay. When applied to existing waste loads, the cal-culated general description of dissolved oxygen levels agreed favorably with observed conditions. e test procedures provide a suitable basis for estimating the effect of proposed changes in the Bay system on water quality and for determining associated treatment and disposal practices necessary to meet desired water quality objectives. The use of the hydraulic model results in a significant saving of both time and expense. (Sinha - OEIS) W74-03622

CIRCULATION IN THE NEAR-SHORE CALIFORNIA CURRENT,

Scripps Institution of Oceanography, La Jolla, For primary bibliographic entry see Field 02L. W74-03624

PREDICTED FLUSHING TIMES AND POLLU-TION DISTRIBUTION IN THE COLUMBIA RIVER ESTUARY, Oregon State Univ., Corvallis. Dept. of Oceanog-

raphy. V. T. Neal.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 2, Part 4, Chap 82, p 1463-1480, 1967. 7 fig, 2 tab. 8 ref.

Descriptors: \*Columbia River, \*Oregon, \*Estuaries, Pollution, Salinity, River flow, Diffusion, Water pollution, Coasts, Distribution, water intrusion, \*Path of pollutants.
Identifiers: Outfalls, Tidal prism, \*Flushing.

The observed salinity distribution in the Columbia River Estuary is used to predict the flushing times for various river discharge rates, varying tidal ranges, and varying salinity intrusions. Both the modified tidal prism method and the fraction of freshwater method are used, and the results are compared. The latter method predicts shorter flushing times, while both methods vary in a similar manner with changing river discharge and changing salinity intrusion. Both methods predict a relatively short flushing time for the estuary. The observed salinity distributions under varying conditions are also used to predict the distribution of conservative and nonconservative pollutants. In this case the fraction of fresh water method and the diffusion equation are used. In general, the fraction of fresh water method predicts higher concentrations. When the lower estuary is divided into two channels, the two methods give quite dif-

# Group 5B-Sources of Pollution

ferent results. The diffusion equation method predicts a peak concentration upstream from the out-fall rather than at the outfall, when the outfall location is arbitrarily placed at certain locations. (See also W74-03699) (Sinha-OEIS)

PRELIMINARY RESULTS AND COMPARISON OF DYE TRACER STUDIES CONDUCTED IN ESTUARIES, AND HARBORS, COASTAL WATERS.

Naval Oceanographic Office, Washington, D.C. L. J. Fisher.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 2, Part 4, Chap 83, p 1481-1492, 1967. 5 fig, 2

Descriptors: Harbors, \*Estuaries, Coasts, \*Pollutants, Spatial distribution, Temporal distribution, \*Tracers, \*Path of pollutants, \*Dye releases. Identifiers: Flushing.

Dye tracer studies have been conducted by the Naval Oceanographic Office in harbors, estuaries, and coastal waters during the past seven years. A brief description of the tracers, equipment, and sampling techniques used, and a discussion of some of the results are presented. Dye tracer techniques are effective for estimating the flushing time and describing the temporal and spatial distribution of a contaminant in a specific area for the environmental conditions existing at the time of the study. The relationships concerning the maximum dye concentration indicate the possibility of developing a simple method for predicting: (1) the decrease in maximum concentration of any type or amount of contaminant released in the study areas during any environmental conditions and (2) the decrease in maximum concentration of a contaminant in other similar areas where tracer studies are not feasible. (See also W74-03699) (Sinha-OEIS)

# 5C. Effects of Pollution

PARABIOTIC GROWTH CHARACTERISTICS OF SELECTED SEWAGE BACTERIA,

Georgia Inst. of Tech., Atlanta. Environmental Resources Center. E. L. Fincher.

Available from the National Technical Information Service as PB-226 769; \$5.25 in paper copy, \$1.45 in microfiche. Project Completion Report ERC-0973, July 1973. 168 p, 56 fig, 76 tab, 20 ref.

\*Aerobic bacteria. Descriptors: Coliforms Sewage bacteria, \*Growth rates, Water pollution

effects, Water pollution sources.

Identifiers: \*Heterotrophic bacteria, Mixed bacterial flora, \*Bacterial interactions, Taxonomic analysis, \*Parabiotic growth apparatus, \*Mesophilic bacteria.

Experimental techniques were developed for use in determining the qualitative changes in the aerobic heterotrophic bacterial populations in raw domestic sewage. Mixed bacterial flora are subject to various ecological pressures such as the availability of metabolizable nutrients. Certain popula-tions may be at a competitive disadvantage because other organisms have a more versitile metabolism which enables preferential utilization of nutritional substrate, alteration of the growth environment through production of metabolic products inhibitory to other organisms, and changes in pH and available oxygen. A raw sewage sample was selected as the model system and held under controlled laboratory conditions. The initial mixed populations emerged into homogeneous populations without overall change in the rate of dissimilation of substrate. The pH decrease seemed to be an important factor in the selection pressure. The study had the important byproduct of developing a system for studying the interaction through chemical exchange among selected bacterial isolates. Measurement of interaction was incorporated in design of a system to monitor changes in cell mass by optical density changes. The system was operated successfully with three rowth chambers. (James - Georgia) W74-03203

SENSITIVITY OF VERTEBRATE EMBRYOS TO HEAVY METALS AS A CRITERION OF WATER QUALITY,

Kentucky Water Resources Inst., Lexington.

W. J. Birge, and J. J. Just. Available from National Technical Information Service as PB-226 850; \$3.00 in paper copy, \$1.45 in microfiche. Research Report No 61, 1973. 20 p, 4 fig, 5 tab, 2 ref. OWRR A-035-KY (1). 14-31-0001-3517.

Descriptors: \*Bioassay, \*Embryonic growth stage, Water quality control, \*Heavy metals, Water pollution effects, \*Chlorides, \*Sodium ar-senite, Cadmium, Mercury, Lead, Zinc, Toxicity, Lethal limit, Monitoring, Frogs, Poultry. Identifiers: Goldfish.

Embryonic and/or larval stages of the leopard frog (Pana pipiens), domestic fowl (Gallus domesticus) and the goldfish (Carassius auratus) were treated with cadmium chloride, mercuric chloride, lead chloride, zinc chloride and sodium arsenite. The principal objectives were (1) to determine the sensitivity of vertebrate embryos to certain metals which are of consequence in water pollution, and (2) to ascertain the suitability of vertebrate embryos as bioassay organisms for monitoring metallic pollutants within water resources. Vertebrate embryos were found to be highly sensitive to the toxic effects of all the metals studied. Concentrations of mercury as low as 10 ppb, with continuous treatment, produced a 100% kill of frog embryos and a significant degree of lethality in chick embryos. Cadmium and lead also produced detectable levels of lethality and/or anomalous development when administered to chick embryos at concentrations of 10 ppb. At 0.5 ppm, mercury and cadmium produced 100% lethality in populations of goldfish embryos treated for four days. Lead and zinc were less toxic to the latter, producing approximately lethality under similar conditions. These results indicate that vertebrate embryos are sub-stantially more sensitive to metallic pollutants than are adult forms, and that they may constitute a valuable tool for monitoring the quality of water resources. (Grieves - Kentucky) W74-03206

THE INFLUENCES OF AN URBAN AREA AND A RESERVOIR ON BENTHIC MACROINVER-TEBRATE PRODUCTION IN THE DES MOINES RIVER, IOWA.

Drake Univ., Des Moines.

J. O. Kennedy. Available from the National Technical Information Service as PB-227 609; \$4.50 in paper copy. M.A. Thesis 1971. 41 p, 8 fig, 4 tab, 34 ref, 6 ap-

Descriptors: \*Benthos, Invertebrates, Reservoirs, \*Iowa, Biomass, \*Productivity, \*Aquatic insects, Water quality, \*Cities. Identifiers: Des Moines River (Ia), \*Trichoptera.

Artificial substrates were used to measure the differences in macroinvertebrates standing biomass, production and turnover ratio at four stations in the Des Moines River from April, 1970 to March, 1971. The location of each station was chosen to demonstrate the effects of an urban area or an impoundment on the productivity of that area. Results showed that members of the insect order Trichoptera were the most abundant organisms collected and that they contributed most to

production. Standing biomass and production values were greatest above the proposed Saylor-ville Dam and below Red Rock Dam. Reduced values for production were found above the urban area, the lowest value below the urban area. (See also W74-03210 and W74-03211) W74-03209

ANALYSIS OF THE BENTHIC MACROINVER-TEBRATE COMMUNITY STRUCTURE FOR ASSESSMENT OF WATER QUALITY OF DES MOINES RIVER,

Drake Univ., Des Moines, Iowa. R. L. Westphal.

Substrates

Available from the National Technical Informa-tion Service as PB-226 785; \$5.00 in paper copy, \$1.45 in microfiche. M.A. Thesis 1973. 49 p, 1 fig, 13 tab, 54 ref.

Descriptors: \*Water quality, \*Iowa, \*Invertebrates, Benthos, \*Aquatic insects, Urbanization, Cities, Sampling. Identifiers: Des Moines River (Ia), \*Trichoptera,

Artificial substrates were used to measure differences in macroinvertebrate species diversity at five stations in the Des Moines River in the metropolitan area of Des Moines to assess water quality. Results showed that members of the insect order Trichoptera were the most abundant organisms collected. An analysis of variance for standardized distance (S.D.) values demonstrated significant difference for sampling dates and location of stations. However, when corrected for current velocity, no significant difference was detected for location of stations, but significance over time was retained. (See also W74-03209 and W74-03211) W74-03210

SPECIES DIVERSITY OF BENTHIC MACROIN-VERTEBRATES IN THE DES MOINES RIVER, IOWA, Drake Univ., Des Moines, Iowa.

D. B. Oestmann.

Available from the National Technical Informa-tion Service as PB-226 775; \$4.00 in paper copy, \$1.45 in microfiche. M.A. Thesis, 1973. 31 p, 1 fig,

Descriptors: \*Benthos, Invertebrates, \*Iowa, \*Cities, \*Reservoirs, Sampling, \*Biological communi-

Identifiers: \*Species diversity, Des Moines River

The biotic community structure of the Des Moines River was assessed in several locations as in-fluenced by a reservoir and a large metropolitan area. Artificial substrate samplers were used as the collecting device and species diversity indices were used for statistical comparison of the communities at various sites in the river. Results showed a significant difference existed between the station above the metropolitan area (station 2) and the station below the metropolitan area (station 3). The community farthest from a 'biological desert' condition was the one immediately below the metropolitan area (station 3). (See also W74-W74-03210) W74-03211

SHORT-TERM EFFECT OF INJECTION OF TERTIARY-TREATED SEWAGE ON IRON CONCENTRATION OF WATER IN MAGOTHY AQUIFER, BAY PARK, NEW YORK, Geological Survey, Mineola, N.Y. S. E. Ragone, J. Vecchioli, and H. F. H. Ku.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 273-290, 1973. 3 fig, 4 tab,

Descriptors: \*Artificial recharge, \*Reclaimed water, \*Injection wells, \*Water pollution effects,

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Effects of Pollution—Group 5C

Iron, Pyrite, Waste disposal wells, Path of pollutants, Hydrogen ion concentration, Tertiary treatment. \*New York. Identifiers: Long Island (NY).

Tertiary-treated sewage (reclaimed water) is recharged by a deep well into the Magothy aquifer, the primary water-supply source for Nassau Coun-ty, Long Island, New York. As of September 1972, 12 recharge tests have been run since the inception of the recharge program in September 1968. Although the iron concentrations of reclaimed and native water averaged 0.44 mg/liter and 0.24 mg/liter, respectively, the iron concentration of the mixed native and reclaimed water at times exceeded 3 mg/liter. The most probable source of iron is the pyrite in the Magothy aquifer. During recharge, the natural reducing condition in the aquifer is replaced by a progressively more oxidizing environment. The initial response to this change is the oxidation of pyrite, which releases Fe into solution. Eventually, ferric hydroxide precipitates, and the Fe concentration decreases. The oxidation mechanism involves inorganic and organic constituents in the reclaimed water. (See also W74-03222) (Knapp-USGS) W74-03232

#### BOTTOM MACROFAUNA IN THE GOCZAL-KOWICE DAM RESERVOIR IN THE YEARS 1965-1969.

Academy of Sciences, Pszczyna. Hydrobiological Station.

E. Krzyzanek.

Acta Hydrobiologica. Cracow, Vol 15, No 2, p 189-196, 1973. 1 fig, 1 tab, 15 ref.

Descriptors: \*Benthic fauna, \*Reservoirs, \*Systematics, \*Speciation, Aquatic animals, Aquatic in-sects, Mollusks, Annelids, Dominant organisms, Nematodes, Crustaceans, Bottom sampling, Oligochaetes, Invertebrates, Water temperature, Hydrogen ion concentration, Aquatic plants, Midges, Diptera, Snails, Tubificids, Caddisflies, Mayflies, Isopods. Identifiers: \*Macroinvertebrates, \*Poland,

Identifiers: \*Macroinvertebrates, \*Poland, Myriophyllum verticillatum, Elodea canadensis, Rorippa amphibia, Armoracia lapathifolia, Unio pictorum, Chironomus plumosus, Procladius, Chironomids, Nais, Orb snails, Pond snails, Biting midges, Leeches, Caenis moesta, Alderflies, Sialis, Asellus aquaticus, Tubifex tubifex, Limnodrilus hoffmeisteri, Anodonta cygnea, Pisidium am-nicum, Pisidium subtruncatum, Pisidium henslovanum, Valvata naticina, Valvata piscinalis, Valvata piscinalis f. antiqua, Valvata pulchella,

Investigations of the bottom macrofauna of the dam reservoir at Goczalkowice were carried out from 1965-1969 as a continuation of those carried out from the beginning of its existence. Samples were taken at permanent points situated in 4 zones of the reservoir for analysis. The temperature of the water was 10 and 25 C, the pH value being 7.5-8.0. In the years 1965-1967 a further decrease in the amount of bottom macrofauna was observed, but from 1968 there was a gradual increase. Oligochaeta and the larvae of Chironomidae (mainly Procladius and Chironomus plumosus) dominated quantitatively. The number of large Mollusca, mainly Unio pictorum, also increased. The upper and central zones were most numerously populated by the bottom macrofauna. Usually the encountered forms had already been noted in previous years. (Holoman-Battelle) W74-03271

CUMULATION OF RADIOACTIVE SUB-STANCE IN DAM RESERVOIRS,

Instytut Gospodarki Kommunalnej, Chorzow (Po-land). Samodzielna Pracowniz Radioekologii. For primary bibliographic entry see Field 05B. W74-03272

FIELD STUDIES ON PHOTOSYNTHESIS OF CLADOPHORA GLOMERATA (CHLOROPHYTA) IN GREEN BAY, LAKE

MICHIGAN, Wisconsin Univ., Madison. Dept. of Botany. M. S. Adams, and W. Stone.

Ecology, Vol 54, No 4, p 853-862, Summer 1973. 4 fig. 1 tab, 30 ref.

Descriptors: \*Photosynthesis, \*Chlorophyta, \*Onsite data collections, Environmental effects, \*Water pollution effects, Aquatic algae, Chemical analysis, Plant tissues, \*Lake Michigan, Primary productivity, Water temperature, Nitrogen, Calcium, Strontium, Sodium, Zinc, Heavy metals, Alkali metals, Alkaline earth metals, Hydrogen ion concentration, Alkalinity, Conductivity, Nitrates, Phosphorus, Copper.
Identifiers: \*Cladophora glomerata, Green Bay,

Chemical composition, Fox River, Seasonal variation, Photosynthetic rates, Data interpretation, Orthophosphates, Ammonium, Barium,

Net photosynthesis of Cladophora glomerata was measured at three sites in lower Green Bay, Lake Michigan, from late spring through summer, 1971. Lower levels of productivity occurred early in the season at two of the sites, when water temperatures were lowest. At the third site water tempera-ture and productivity varied the least. Contrary to other reports, it was found that Cladophora made relatively efficient use of low illumination. Under statistically similar temperature and irradiance levels, productivity was higher with increasing proximity to the mouth of the Fox River. Nitrogen, calcium, strontium, sodium, and zinc also were highest in concentration in plants receiving the greatest amount of effluents from the Fox River in comparison with the site receiving the least. Site differences in productivity appear to be related to nutrient levels, whereas seasonal differences in productivity are probably most closely related to seasonal temperature differences. (Holoman-Battelle) W74-03274

#### AN IN SITU EXAMINATION OF THE GRAZING ACTIVITIES OF NATURAL ZOOPLANKTON COMMUNITIES.

Toronto Univ. (Ontario). Dept. of Zoology.

J. F. Haney. Archiv fur Hydrobiologie, Vol 72, No 1, p 87-132, June 1973. 21 fig, 6 tab, 93 ref.

Descriptors: Grazing, \*Eutrophication, Descriptors: Grazing, Eutrophication, 

\*Zooplankton, \*Primary productivity, \*Canada, 

\*Feeding rates, \*Trophic level, \*Oligotrophy, 

\*Bogs, Dominant organisms, Diurnal distribution, 
Seasonal, Foods, Radioactivity techniques, 
Waterfleas, On-site tests, On-site investigations, 

\*Boards | Proceedings | Proceedings | Procedure Dissolved oxygen, Depth, Phytoplankton, Suspended solids, Methodology, Statistical methods, Crustaceans, Copepods, Vertical migration, Yeasts, Bacteria, Algae. Identifiers: Heart Lake, Data interpretation.

In Heart Lake, grazing rates for the water column exceed 100 percent/day in the summer, but become less than 10 percent/day during the winter. The lower vertical boundary of zooplankton filterfeeding is closely defined by a 1 ppm dissolved oxygen isopleth during summer stratification. Grazing rates measured with different food items showed some seasonal differences. The popula-tions of dominant filter-feeding zooplankton species in Heart Lake corresponded with grazing rate maxima and minima recorded during the same period. Daphnia rosea and D. galeata were the most important grazers in Heart Lake, 1969, together accounting for approximately 80 percent of the total annual grazing activity. Several species of zooplankton migrate vertically in Heart Lake, resulting in shifts of grazing to the upper stratum at night. At least some species filter more rapidly at night. Eutrophic Heart Lake and the acid bog lake were very similar, with intense grazing by Cladocera limited vertically to the upper 3 meters.

In contrast, copepod domination of the zooplankton and extremely low grazing rates uniformly dis-tributed throughout the water column charac-terized the oligotrophic lake. A comparison of grazing rates and primary productivity in these three lakes showed (1) high grazing and high pri-mary productivity in Heart Lake (2) high grazing and low primary productivity in the bog lake and (3) low grazing and moderate primary productivity in the oligotrophic lake. Phytoplankton renewal rates in oligotrophic lakes are generally far in excess of zooplankton grazing rates, whereas in eutrophic lakes the two rates are comparable. Grazing rates of zooplankton communities were measured in situ by automatically releasing a small quantity of P-32-labeled cells (yeast, algae, and cteria) inside a plexiglass grazing chamber in the lake and assaying the zooplankton for radioactivity after 5 min feeding. Studies were conducted in the eutrophic Heart Lake and on two occasions in a deep oligotrophic lake and a shallow acid bog. (Little-Battelle) W74-03276

# NITROGEN FIXATION BY THE UNICELLU-LAR BLUE-GREEN ALGA APHANOTHECE, Central Rice Research Inst., Cuttack (India). Dept.

of Blue-Green Algae. P. K. Singh.

Archiv fur Mikrobiologie, Vol 92, No 1, p 59-62, July 10, 1973. 4 fig, 12 ref.

Descriptors: \*Nitrates, \*Bioassay, \*Nutrient requirements, \*Nitrogen fixation, \*Cyanophyta,

Identifiers: \*Aphanothece, \*India, Culture media, Plectonema, Anacystis, Substrate utilization.

The alga Aphanothece sp., which grows vigorously in rice fields of the Central Rice Research Institute, India, was isolated for use in determining rates of nitrogen fixation in media free of combined nitrogen. Nitrogen fixation was estimated by the micro-Kjeldahl technique. Cells were counted using a haemocytometer. The alga grew well both in media containing nitrate and in media lacking nitrate. Little lag occurred when cells grown in medium containing nitrate were transferred to a nitrate-lacking medium, and growth continued for 18-25 days. The generation time for this alga was 12 hr, and more than 2 mg of N were fixed in 25 days. Other algae (Plectonema and Anacystis) from a similar habitat failed to grow in medium lacking nitrate. (Little-Battelle) W74-03278

#### TOXICITY OF THE HERBICIDE KURON (SIL-VEX) TO BLUEGILL EGGS AND FRY North Carolina Cooperative Sport Fishery Unit.

Raleigh.
R. L. Wilbur, and E. W. Whitney.
Transactions of the American Fisheries Society, Vol 102, No 3, p 630-633, July 1973. 1 tab, 7 ref.

Descriptors: \*Pesticide toxicity, \*Herbicides, Fish eggs, Fry, \*North Carolina, \*Water pollution effects, \*Bioassay, Fish reproduction, \*Sunfishes, Freshwater fish, Chlorinated hydrocarbon pesticides Lettel limit. cides, Lethal limit.

Identifiers: Kuron, \*Lepomis macrochirus, Survival, Median tolerance limit.

Experimental treatment with herbicide Kuron of two alligatorweed-infested North Carolina streams was initiated by the U.S. Army Corps of Engineers in summer, 1965. Surveillance of fish and invertebrate populations was provided by the U.S. Bu-reau of Sport Fisheries and Wildlife. The effects of Kuron on bluegill eggs and fry were examined under laboratory conditions to provide insight on how reproduction of the sunfish family may have been affected by Kuron treatments applied to the streams. Eggs from each of nine bluegills were treated with Kuron concentrations of 0.0 ppm (control), 1.0 ppm, 1.0 ppm, 5.0 ppm, and 10.0 ppm

# Group 5C-Effects of Pollution

acid equivalents. Analysis of variance indicated that hatching was not significantly affected by treatments but that survival of fry to an age of 6 days was affected by the treatments. No fry survived at 10.0 ppm and only a token few survived the 5.0 ppm treatment. (Holoman-Battelle) W74-03279

GERMANIUM INCORPORATION INTO THE SILICA OF DIATOM CELL WALLS.

California Univ., San Diego, La Jolla. F. Azam, B. B. Hemmingsen, and B. E. Volcani. Archiv fur Mikrobiologie, Vol 92, No 1, p 11-20, July 10, 1973. 3 fig, 1 tab, 25 ref.

Descriptors: \*Diatoms, \*Growth rates, \*Absorption, \*Bioassay, Radioactivity techniques, Plant metabolism, Biochemistry, Cytological studies, Cultures. Toxicity.

Identifiers: \*Germanium, Silicon, \*Metabolic pathways, Transport, Viability, Nitzschia alba, Cylindrotheca fusiformis, Cyclotella nana, Navicula pelliculosa, Ge-68, Germanic acid, Silicic acid.

A non-photosynthic diatom, Nitzschia alba; two marine photosynthetic diatoms, Cylindrotheca fusiformis and Cyclotella nana; and a freshwater photosynthetic diatom, Navicula pelliculosa, were exposed to various ratios of Ge-68-labeled Ge (OH)4/Si (OH)4 (0.01, 0.1, or 1.0) in an attempt to trace the metabolic fate of Ge and to examine the possibility that Ge might follow the same metabolic pathway as Si. Cell counts, viability, Ge uptake and incorporation, isotope discrimination, silicic acid uptake, and effects of Ge on metabolism were determined. The diatoms took up labelled germanic acid from their growth media and incorporated up to 80 percent of it into the silica of their cell walls. Silicification appeared to be required for germanium incorporation. The uptake and incorporation of germanic acid was dependent upon the relative concentrations of Ge and Si. At Ge/Si of 0.01, no inhibition of growth or of silicic acid uptake by N. alba was observed. The cell morphology was also normal and 60 to 80 percent of the Ge-68 taken up was incorporated. At Ge/Si of 0.1, silicic acid uptake and growth of N. alba were inhibited by about 95 percent. Concomitantly, striking morphological aberrations occurred. 10 to 20 percent of the Ge-68 (OH)4 taken up was incorporated. The possible use of labeled Ge (OH)4 for the study of silicon metabolism is discussed. (Little-Battelle) W74-03280

EDAPHIC FACTORS AND WILT OF CORI-

Raiasthan Univ. Jaipur (India). U. S. Srivastava.

Indian Phytopathol. Vol 24, No 4, p 679-683. 1971

Identifiers: \*Coriander, \*Edaphic factors, Fusarium-Oxysporum-f-Corianderii, Moisture, Mortality, \*Soil temperature, \*Wilt, Hydrogen ion concentration.

The influence of soil temperature on disease development was studied in soil temperature tanks at 20, 24, 28, and 33C plus or minus (1C). A maximum wilting of 75% occurred at 28C; avobe or below this temperature mortality percentage decreased. Population of the pathogen (Fusarium oxysporum f. corianderii) was also highest at this temperature. Maximum mortality (60.71%) occurred in pH 5.8-6.9. Disease percentage increased with increase in moisture holding capacity (MHC). However, the population of the pathogen was highest at 52% MHC, much below the saturation point.—Copyright 1973, Biological Abstracts, Inc. W74-03281 THE OCCURRENCE OF MICROTURBEL-LARIA IN SOME BRITISH LAKES OF DIVERSE CHEMICAL CONTENT,

Liverpool Univ. (England). Dept. of Zoology. I O Young

Archiv fur Hydrobiologie, Vol 72, No 2, p 202-224, July 1973. 6 tab, 30 ref.

Descriptors: "Calcium, "Lakes, "Population, "Distribution patterns, Water quality, Sampling, Separation techniques, Essential nutrients, Nutrient requirements, Seasonal, Aquatic Nutrient requires habitats, Nutrients.

Identifiers: \*Turbellari, Flatworms. England. Catenula lemnae, Stenostomum grabbskogense, Stenostomum leucops, Stenostomum unicolor, Microstomum lineare, Macrostomum distinguendum, Macrostomum johni, Macrostomum ros-tratum, Prorhynchus stagnalis, Geocentrophor sphyrocephala, Geocentrophora

The distribution and seasonal occurrence of Microturbellaria in three different habitats in the littoral zone of calcium-rich, lowland, 'productive' lakes and calcium-poor, upland, 'unproductive' lakes were investigated over the course of a year using tree different sampling methods. Sampling methods, and methods used in the extraction from samples and identification of Microturbellaria are described. Eleven species occurred in both lake types, eight species occurred in Ca-rich lakes, and eleven species occured in Ca-poor lakes. The total number of species collected from 6 calcium-rich and 6 calcium-poor lakes visited at monthly intervals over a year ranged from 9 to 12 species and 3 to 18 species, respectively. Species recorded frequently seemed to have a wide distribution within the range of habitats considered in each lake. Species with a more restricted habitat distribution were these recorded only infrequently. A study of the vertical distribution of Microturbellaria on the floor of a calcium-rich lake suggested that some species were confined to the littoral and other species occurred also in the deeper water. The peak number of specimens recorded in calcium-poor and calcium-rich lakes occured in July and May to July, respectively. Ecological notes are presented on some of the common species found. (Little-Battelle) W74-03282

STUDIES ON PHYTOPLANKTON IN RELA-TION TO ITS PRODUCTION AND SOME PHYSICAL-CHEMICAL FACTORS IN LAKE SVINSJOEN.

Oslo Univ. (Norway). Dept. of Limnology. A. Lande.

Archiv fur Hydrobiologie, Vol 72, No 1, p 71-86, June 1973. 8 fig, 6 tab, 19 ref.

Descriptors: \*Primary productivity, Dominant organisms, \*Physicochemical properties, Radioactivity techniques, \*Cyanophyta, \*Diatoms, \*Dinoflagellates, \*Chlorophyta, Phytoplankton, Hydrogen ion concentration, Iron, Manganese, Phosphates, Calcium, Magnesium, Dissolved ox-Phosphates, Calcium, Magnesium, Dissolved Ox-ygen, Alkalinity, Sodium, Potassium, Sulfates, Chlorides, Bicarbonates, Sampling, Specific con-ductivity, Water quality, Trophic level, Biomass. Identifiers: Lake Svinsjoen, "Norway, "Dark bottle method, Orthophosphates, C-14, Anabaena flos-aquae, Tetraedron punctulatum, Closterium aciculare, Pediastrum boryanum, Staurastrum aciculare, Pediastrum boryanum, Staurastrum gracile, Cyclotella comta, Synedra acus, Tabel-laria flocculosa, Fragilaria crotonensis, Ceratium hirundinella

Limnological investigations were carried out during 1968 and 1971 on Lake Svinsjoen, a moderately eutrophic lake about 30 km southwest of Oslo. Investigations included measurements of primary production, quantitative phytoplankton, pH, specific conductivity, Fe, Mn, orthophosphate, Ca, Mg, oxygen, alkalinity, Na, K, sulfate, chloride, and bicarbonates. Primary production was determined by the dark bottle method and by C-14 uptake. Samples were collected from various depths with a transparent Ruttner water sampler and transferred to glass and polyethylene bottles for analysis. The results show that pH values lie between 7.0 and 9.0 in mixolimnion during the summer season, and the calcium content is about 30 mg/1. The orthophosphate content is about 10-15 micrograms/1 in mixolimnion during the winter. but the summer measurements show values below 3 micrograms/1. The dominating phytoplankton species in 1971 were the diatoms Cyclotella comta species in 1971 were the diatoms Cyclotella comta and Synedra acus during May and June, and the Chlorophyta species Tetraedron punctulatum dur-ing July and August. The highest number of Tetraedron cells was 9,200,000 cells/1, found in August 1971. The two methods of determining primary productivity on some occasions gave dif-ferent results which were difficult to justify. A study of the relation between the primary produc-tion and the standing crop of phytoplankton, shows that the daily renewal coefficient lies between 1.0 and 0.3 in Svinsjoen. (Little-Battelle)

CHRONIC EFFECT OF LOW PH ON FATHEAD MINNOW SURVIVAL, GROWTH AND REPRODUCTION,
National Water Quality Lab., Cincinnati, Ohio.

Newton Fish Toxicology Lab. D. I. Mount.

Water Research, Vol 7, No 7, p 987-993, July 1973. 4 tab. 9 ref.

Descriptors: \*Hydrogen ion concentration, \*Fish physiology, \*Toxicity, \*Water pollution effects, \*Bioassay, \*Growth stages, Animal growth, Fish behavior, Fish reproductions, Fish eggs, Laboratory tests, Lethal limit, Dissolved oxygen, Water quality, Alkalinity, Acidity, Hardness (Water), Freshwater fish.

Identifiers: \*Fathead minnow, Pime promelas, Survival, Median tolerance Pimephales promelas, Sur Teratogenicity.

Fathead minnows (Pimephales promelas) were continuously exposed to reduced pH levels of 4.5, 5.2, 5.9 6.6, and 7.5 (control) during a 13-month, one-generation test in order to measure the effect of such exposure on reproduction and growth of these fish. Since the TL sub 50 to the minnows was close to 4.0, two acute tests were performed in the same system after the chronic test to determine the lethal pH. Survival was not affected, even at the lowest pH tested. Fish behavior was abnormal, and fish were deformed at pH 4.5 and 5.2. Egg production and egg hatchability were reduced at pH 5.9 and lower, and all eggs were abnormal. A pH of 6.6 was marginal for vital life functions, but safe for continuous exposure. Free carbon dioxide, liberated by the addition of sulfuric acid to reduce the pH, may have had an unknown effect. The fish did not become acclimated to low pH levels. The TL sub 50 values in the acute tests were 4.05 and 4.2. In one test all fish died in the chamber maintained between pH 3.6 and 3.8, while all survived in Ph 4.5-4.6. In the other test 20 percan survived in rn 4.3-4.6. In the other test 20 percent survived pH 4.1-4.3 and none died at 4.5. Since exact lethal levels were not essential and pH control was very difficult, no further refined testing was done. (Holoman-Battelle) W74-03288

THE REALITY OF THREE BRITISH BIOTIC

INDICES,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Dept. of Water Technology.
For primary bibliographic entry see Field 05A.
W74-03289

THEORETICAL EFFECTS OF ARTIFICIAL DESTRATIFICATION ON ALGAL PRODUC-TION IN IMPOUNDMENTS, Harvard Univ., Cambridge, Mass. Lab. of Applied Microbiology.

M. Lorenzen, and R. Mitchell. Environmental Science and Technology, Vol 7, No 10, p 939-944, October 1973. 5 fig, 1 tab, 21 ref.

Descriptors: \*Destratification, \*Impoundments, \*Primary productivity, Effects, Limiting factors, \*Eutrophication, Depth, Model studies, Aquatic \*Futrophication, Depth, model studies, Aquatic productivity, Respiration, Biomass, Photosynthe-sis, Lakes, Reservoirs, \*Mixing, Deficient ele-ments, Growth rates, Light, Environmental ef-fects, Water pollution effects. Identifiers: \*Nutrient depletion, Artificial mixing.

Artificial mixing is an important tool in the management of eutrophic lakes and reservoirs. Theoretical models of phytoplankton production are briefly reviewed and a model for application to mixed impoundments is derived. The model con-siders both nutrient depletion and the balance between photosynthesis and respiration as potential biomass limiting factors. The results of model calculations show that nutrient limited biomass is directly proportional to the depth of mixing, whereas light-limited peak biomass decreases linearly with increased depth of mixing. It is believed that in impoundments where artificial destratification is a successful control technique, nutrient limited algal blooms are replaced by lightlimited blooms of smaller magnitude. The most important variables are the depth available for mix-ing and the attenuation of light in the water column. (Holoman-Battelle) W74-03296

ACUTE TOXICITY OF BERYLLIUM SULFATE TO THE COMMON GUPPY, Aerospace Medical Research Lab., Wright-Patter-

son AFB, Ohio.

A. R. Slonim. Journal Water Pollution Control Federation, Vol 45, No 10, p 2110-2122, October 1973. 1 fig, 7 tab,

Descriptors: \*Toxicity, \*Beryllium, \*Bioassay, Water pollution effects, Age, Absorption, Environmental effects, Water chemistry, Allkaline earth metals, "Lethal limit, Freshwater fish, Hydrogen ion concentration, Hardness (Water), Resistance, Water analysis, Chlorine, Dissolved

Resistance, Water analysis, Chlorine, Dissolved oxygen, Specific conductivity, Alkalinity, Laboratory tests, Water temperature, Regression analysis, Correlation analysis. Identifiers: "Guppy, Median tolerance limit, "Bioaccumulation, Lebistes reticulatus, Beryllium radioisotopes, Data interpretation, Buffers, Animal tissues, Intestine, Kidneys, Operica.

The acute toxicity of beryllium sulfate solutions to guppies was determined in five static bioassays. Other bioassays evaluated those factors that may affect the median tolerance limits such as the fish age, increase of pH, and previous exposure to eryllium. Some preliminary radioberyllium studies on Be uptake in guppies are presented to gain some insight into the mechanism of Be toxicity. The 96-hour median tolerance limit was 20.3 mg/1 in hard water and 0.19 mg/l in soft water. Acute toxicity was independent of fish age but reduced to some extent by buffering the solutions. Proper preexposure conditioning significantly increased the tolerance of guppies to very toxic concentra-tions. Radio-beryllium data on exposed fish and some individual organs, as well as on the effects of various factors on beryllium uptake, were reviewed in conjunction with the toxicity data. These results indicate that the toxicity and lethality may not depend on the amount of beryllium concentrated within the fish, but more likely on the effect on a particular target organ or cellular or subcellular component. (Holoman-Battelle) W74-03297

EFFECTS OF RESIDUAL CHLORINE ON AQUATIC LIFE, National Water Quality Lab., Duluth, Minn.

W. A. Brungs.

Journal Water Pollution Control Federation, Vol 45, No 10, p 2180-2193, October 1973. 3 tab, 157

Descriptors: "Aquatic life, "Water pollution effects, "Industrial wastes, "Pollutant identification, "Waste water (Pollution), "Municipal wastes, Toxicity, Aquatic animals, On-site tests, Laboratory tests, Chlorination, Methodology, Lethal limit, "Municipal wastes, Toxical Conference," Efficiency, School Conference, Mortality, Waste water treatment, Effluents, Marine animals, Marine plants, Persistence, Aquatic plants, Chlorine, Water quality, Water quality standards, Chemical wastes, Trout, Sal-

mon. Identifiers: "Chlorine residual, Species diversity, Dechlorination, Chloramines, Amperometric titration, Carcinogenicity, Iodometry, Chlorophenols, Coho salmon, Smallmouth bass, White sucker, Largemouth bass, Fathead minnow, Black bullhead, Golden shiner, Scuds, Daphnia magna, Median tolerance limit, Green sunfish, Continuous flow technique, Species diversity index, Gammarus pseudolimnaeus, Pouch snails, Orconectes virilis.

Increased use of chlorine and recent studies of residual chlorine toxicity in aquatic systems have residual chlorine toxicity in aquatic systems have emphasized the need for close scrutiny of present disinfection procedures. This review discusses chlorine uses and chlorine chemistry and emphasizes toxicity studies in the field and in the laboratory. Interim criteria, based on knowledge residual chlorine are: (1) in areas receiving wastes treated continuously with chlorine, not to exceed treated continuously with chlorine, not to exceed 0.01 mg/1 for the protection of more resistant organisms only, or not to exceed 0.02 mg/1 for the protection of most aquatic organisms; and (2) in areas receiving intermittently chlorinated wastes, not to exceed 0.2 mg/1 for a period of 2 hr/day for more resistant species of fish, or not exceed 0.04 mg/1 for a period of 2 hr/day for trout and salmon. If free chloring persists, more restrictive criteria If free chlorine persists, more restrictive criteria are warranted. Alternate procedures or substitutes for chlorination should be investigated. (Holoman-Battelle) W74-03298

HALF-SATURATION CONSTANTS FOR UP-TAKE OF NITRATE AND AMMONIA BY RESERVOIR PLANKTON.

Oklahoma State Univ., Stillwater. Dept. of Zoolo-

By. D. W. Toetz, L. P. Varga, and E. D. Loughran. Ecology, Vol 54, No 4, p 903-908, Summer 1973. 6 fig, 4 tab, 16 ref.

Descriptors: "Absorption, "Ammonia, "Nitrates, "Plankton, "Reservoirs, Water temperature, Nitrogen compounds, Cyanophyta, Aquatic algae, Radioactivity techniques, Tracers, Nitrites, Laboratory tests, Surface waters, Anabaena, Kinetics, "Oklahoma.

Identifiers: Lake Carl Blackwell, Half saturation constants, Sample preparation, Michaelis-Menten constants, Sample preparation, Michaelis-Menten equation, Transparency, Sample preservation, Particulate nitrogen, Lake Keystone, Substrate concentration, Anacystis, Nodularia, Aphanizomenon, Oscillatoria, Turnover rates, Vertical distribution

Observations were made in order to learn if the uptake of NH4 and NO3 by freshwater plankton can be described by the Michaelis-Menten expression. Uptake of NO3 and NH4 by reservoir plankton was estimated at 5 concentrations using N-15 tracer techniques. A hyperbola results when the uptake velocity (v) of NO3 and NH4 is plotted against concentration (S). The S/v vs S transfor-mation of the Michaelis-Menten expression was used to estimate K sub s. For a mixed population of blue-green algae in Lake Carl Blackwell, Oklahoma, K sub s was about 43 mg NO3-N/ (cu when the initial concentration was 7.53 mgNO3-N/ (cu m). In Lake Keystone, where the initial concentration of NO3-N was 419.17 mg/ (cu m), enrichment with NO3 increased v in a similar way, suggesting use of the Michaelis-Menten model may not be realistic. (Holoman-Battelle) W74-03299

SEASONAL CHANGES IN POPULATION DENSITY AND VERTICAL DISTRIBUTION OF PROSOBRANCE VELIGERS IN OFFSHORE PLANKTON AT PLYMOUTH,

PLANKTON AT PLYMOUTH, Reading Univ. (England). V. Fretter, and D. Shale. Journal of the Marine Biological Association of the United Kingdom, Vol 53, No 3, p 471-492, Au-gust 1973. 10 fig, 2 tab, 22 ref.

Descriptors: \*Larval growth stage, \*Ecological distribution, \*Gastropods, Mollusks, Invertebrates, Salinity, Water temperature, Vertical migration, Plankton, Larvae, Snails, Water sampling, Marine animals, \*Distribution patterns,

Speciation, Animal populations.
Identifiers: \*Veligers, \*Population density,
\*Seasonal variation, Vertical distribution, Sample preservation, Marine environment, Phaeocystis, Lacuna vincta, Littorina littorea, Littorina neritoides, Cingula semistriata, Alvania crassa, Alvania punctura, Rissoa sarsi, Rissoa inconspicua, Rissoa parva, Rissoa membranacea, Tornus sub carinatus, Turritella communis, Caecum imperforatum, Bittium reticulatum, Cerithiopsis tu-bercularis, Cerithiopsis barleei, Triphora perver-sa, Aclis minor, Balcis alba, Balcis devians.

Vertical and horizontal hauls were taken at approximately fortnightly intervals from April 1969 to April 1970 at L 3 (lat. 40 degrees 17.7 minutes N, long. 4 degrees 11.2 minutes W) and L 4 (lat. 50 degrees 15 minutes N, long. 4 degrees 12.5 minutes W). Thirty-two species of prosobranch veliger were present at L 3; these larvae were not as numerous at L 4 and only 26 species were recorded.

The number of species was highest in the summer:
the number of veligers was highest in February. After mid October both the number of species and the abundance of veligers decreased rapidly and remained low until early February. Veligers of some species occurred later at L 3 and L 4 than in more inshore waters and these were probably individuals carried beyond tidal influences which would normally lead to settlement on the shore. They included Lacuna vincta, Littorina littorea and L. neritoides. Veligers of all ages were found at all depths. At their time of greatest abundance veligers of many species occurred maximally at 5 or 10 m, with a variable decrease towards greater depths and a sudden one towards the surface. This distribution later changed giving a proportionally greater number at greater depth. When numbers were low the larvae scattered through the water column with little or no indication of a preferred depth. An examination of the age composition of ligers of rissoids, Natica alderi, Nassarius reticulatus and Philbertia linearis from certain catches showed that the surface accumulation at the time of abundance was composed of a high percentage of young veligers: in an ageing population there was a higher percentage of larvae, especilly the older ones, at greater depths, except for Nassarius reticulatus which consistently showed maximal numbers above 10 m until the larvae became scarce. When blooms of Phaeocystis occurred they affected the distribution, driving the larvae away from the surface. (Holoman-Battelle) W74-03300

BROWN SEAWEED AS AN INDICATOR OF HEAVY METALS IN ESTUARIES IN SOUTH-WEST ENGLAND.

Marine Biological Association of the United King-

dom, Plymouth (England). Plymouth Lab. G. W. Bryan, and L. G. Hummerstone. Journal of the Marine Biological Association of the United Kingdom, Vol 53, No 3, p 705-720, Au-gust 1973. 8 fig, 3 tab, 11 ref.

# Group 5C-Effects of Pollution

Descriptors: "Phaeophyta, "Kelps, "Estuarine environment. "Heavy metals, "Bioindicators, vironment, \*Heavy metals, \*Bioindicators, \*Water pollution, \*Pollutant identification, Plant tissues, Chemical analysis, Water analysis, Marine algae, Marine plants, Estuaries, Copper, Zinc, Lead, Manganese, Iron, Trace elements, Water sampling, Water quality, Ecological distribution, Aluminum, Surface waters, Salinity, Tidal effects, Methodology.

Identifiers: Seasonal variation, England, Biological magnification, Fucus vesiculosus, Tamar Estuary, Restronguet Creek, Fal Estuary, Dart Estuary, Camel Estuary, Sample preparation, Vertical distribution, Atomic absorption spec-trophotometry, Flame emission spectrophotometry

Concentrations of copper, zinc, lead, aluminum, manganese and iron in the brown seaweed Fucus vesiculosus have been measured in samples collected over its range of distribution in four estua-ries having different degrees of metal contamination. Factors controlling the concentrations in the weed have been studied and include ithe concentrations of metals in the water, seasonal changes, the position of the weed in the intertidal zone and the particular portion of the plant which is analyzed. It is conclueded that analysis of the weed gives a reasonable indication of average conditions in the water at points along an estuary and provides a method of making comparisons with the same estuary in subsequent years or with other estuaries. (Holoman-Battelle) W74-03301

THE ZOSTERA EPIFAUNAL COMMUNITY IN THE YORK RIVER, VIRGINIA, Florida Atlantic Univ., Boca Baton. Dept. of

Biological Sciences.

For primary bibliographic entry see Field 05A. W74-03302

MORTALITY OF MARKET-SIZED OYSTERS (CRASSOSTREA VIRGINICA) IN THE VICINI-TY OF A DREDGING OPERATION, Maryland Univ., Solomons. Natural Resources

C. D. Rose

Chesapeake Science, Vol 14, No 2, p 135-138, June 1973. 1 fig, 1 tab, 10 ref.

Descriptors: \*Mortality, \*Dredging, \*Sedimenta-tion, \*Environmental effects, Oysters, Mollusks, Marine animals, Spoil banks, Bottom sampling, Shellfish farming, Shellfish, Estuarine environ-ment, Invertebrates, \*Louisiana.

Identifiers: \*Eastern oyster, Crassostrea virginica, Palmetto Bayou (La), Macroinvertebrates, Data interpretation.

The oyster lease in Palmetto Bayou, southern Louisiana, was inspected 4-5 months after dredging occurred to determine sediment-induced damage to market-sized oysters. It was assumed that mortality near the spoil bank would exceed that at site further from the bank. The average mortality of market-sized oysters collected at seven sampling stations within 595 m of a spoil bank crossing the oyster lease was 57 percent, as compared to an average mortality of 17 percent of the remainder of the lease. Sediment (2-15 cm thick) commonly covered oysters taken from the affected area. Theoretical mortality was estimated to be 48 percent. (Holoman-Battelle) W74-03305

COMPARATIVE ECOLOGY AND ZOOPLANK-TON OF TWO MARYLAND PONDS INCLUD-ING A CONGENERIC OCCURRENCE OF DIAP-TOMUS (CALANOIDA: COPEPODA).

Edgewood Arsenal, Aberdeen Proving Ground, Md

J. C. Smrchek.

Chesapeake Science, Vol 14, No 3, September 1973, pp 188-196. 1 fig, 7 tab, 42 ref.

Descriptors: \*Zooplankton, \*Ecology, \*Ponds, Freshwater, \*Crustaceans, Copepods, Invertebrates, Physicochemical properties, Aquatic plants, Speciation, Water chemistry, Waterfleas, Growth stages, Rotifers, Carbon dioxide, Dissolved oxygen, Hardness (Water), Hydrogen ion concentration, Aquatic animals, Surface waters, Air temperature, Water temperature, Chara, Submerged plants, Oak trees, Water analysis, Benthic fauna, \*Maryland.

Identifiers: \*Species abundance, Macrophytes,

Identifiers: \*Species abundance, Macrophytes, Liverwort, Ricciocarpus natans, Macroinver-tebrates, Calanoida, Liquidamber styraciflua, Ilex opaca, Quercus palustris, Quercus phellos, Jussiaea repens var. glabrescens, Acer rubrum, Nyssa sylvatica, Prunus serotina, Duck potato, Reed grass, Great duckweed, Pickerelweed, Water starwort, St. John's-worts, Tupelos, Red maple, Diap-tomus (Onychodiaptomus) birgei, Nauplii, Copepodids, Water primrose, False loosestrife, Ludwigia palustris, Sedges, Cyperus strigosus, Hypericum.

Two freshwater ponds, one permanent (Pond 1) and the other temporary (Pond 2), located on the western Maryland shore of the upper Chesapeake Bay were studied periodically from April 1970 to January 1971. Periodic physiochemical data, plant and zooplankton samples, and general seasonal observations were obtained. The temporary pond became dry in mid-September and remained so until late November. Free carbon dioxide, dissolved oxygen, and hardness fluctuated irregularly throughout the study. In August the pH in the permanent pond decreased greatly with little subsequent recovery. After Pond 2 again contained water, hardness increased to over 400 percent of values before drying. Lists of aquatic flowering plants were prepared for both ponds. Each pond contained a distinct assemblage of zooplankters probably influenced by the amount of aquatic vegetation present. Total zooplankton species numbers in each pond were almost equal, but the temporary pond contained greater quantities of zooplankton. Two generations per year of D. san-guineus were found in Pond 2. Eubranchipus vernalis (Verrill) and E. holmani (Ryder) were found in December in Pond 2; the general life cycle of these anostracans is briefly outlined. A congeneric occurrence of two calanoid copepods Diaptomus birgei Marsh and D. sanguineus Forbes was found May in temporary Pond 2. Both are of the same subgenus (Onychodiaptomus Light). Various causes and mechanisms explaining congeneric ocurrences are briefly reviewed. Slight size differences, insufficient time due to several factors discussed, for competitive exclusion to operate to to best explain the present co-occurrence. (Holoman-Battelle) W74-03308

THE BIOLOGY OF BROWN ALGAE ON THE ATLANTIC COAST OF VIRGINIA. II. PETALONIA FASCIA AND SCYTOSIPHON LO-

MENTARIA, Kent State Univ., Ohio. Dept. of Biological Sciences.

For primary bibliographic entry see Field 05A. W74-03309

A CONTRIBUTION TO THE ECOLOGY AND DISTRIBUTION OF AQUATIC ACARI IN THE ST. LAWRENCE GREAT LAKES, Wisconsin Univ., Milwaukee. Center for Great

Lakes Studies. R. F. Modlin, and J. E. Gannon.

Transactions of the American Microscopical Society, Vol 92, No 2, p 217-224, April 1973. I fig, 2 tab, 21 ref

Descriptors: \*Ecological distribution, \*Great Lakes, \*Aquatic habitats, \*Ecology, Limiting fac-tors, Speciation, Animal groupings, Invertebrates, Plankton, Benthic fauna, Aquatic animals, Mites, Lake Erie, Lake Michigan, Lake Huron, Lake Su-

perior, Bottom sampling, Water sampling, Animal populations, Profundal zone, Littoral, Systematics, Aquatic plants.

Identifiers: \*Water mites, \*Hydracarina, Neuston, Species abundance, Sample preservation, Arachnids, Lake St. Clair, St. Mary's River, Hammond Bay, Thunder Bay, Green Bay, Sampling equipment, Arrenurus americanus, Arrenurus apetiolata, Arrenurus manubriator, Atractides indistinctus, Axenopsis, Eylais desecta, Eylais ex-tendens, Forelia cooki, Frontipoda americana, Hygrobates longipalpis, Koenikea, Lebertia porosa, Limnesia fugica, Limnesia histrionica, Limnesia maculata, Limnesia paucispina, Limne-

Aquatic Acari were investigated in benthic, planktonic, and neustonic habitats in Lakes Michigan, Huron, Superior, and St. Clair. Sampling was carried out using bottom grab samplers, plankton nets and specially designed floating nets modified from Zaitsev (1963). The mites were preserved in 10 per-cent formalin in the field and transferred to Koenike's solution in the laboratory. Temporary mounts were made in 50 percent lactic acid solution. Of the 382 Great Lakes specimens examined, 15 genera and 21 species were found. These collections increased the number of known Great Lakes water mites to 21 genera and 32 species. The water mites were not abundant in terms of biomass nor species composition. The scarcity of aquatic vegetation is an important limiting factor. Benthic littoral and sublittoral habitats had the greatest numbers of individuals and species. Species com-position and biomass diminished rapidly with depth. Hygrobates longipalpis and Lebertia porosa were most abundant and widely distributed in benthic habitats. Piona rotunda and Unionicola crassipes were most common in the plankton and Hydrozetes, Limnohalacarus, and Soldanellonyx were unique to the neuston. (Holoman-Battelle) W74-03314

BIOTIC CHARACTER AS RELATED TO STREAM MINERAL CONTENT,
North Dakota Univ., Grand Forks. Dept. of Biolo-

J. K. Neel, Sr.

Transactions of the American Microscopical Society, Vol 92, No 3, p 404-415, July 1973. 7 tab,

Descriptors: \*Ecological distribution, \*Water quality, \*Kentucky, \*Virginia, Biological properties, Natural streams, \*Benthos, Aquatic animals, Aquatic plants, Water chemistry, Bottom sampling, Water sampling, Aquatic algae, Inversamping, water samping, Aquatic algae, inver-tebrates, Systematics, Organic matter, Mollusks, Aquatic insects, Annelids, Crustaceans, Water analysis, Mineralogy, Phosphorus, Nitrogen, Sub-merged plants, Diatoms, Ammonia, Clams, Nitrites, Crayfish, Snails, Alkalinity, Hardness (Wetce), Morganizm, Calcing, Alkalinity, Hardness

Nitrites, Crayfish, Snails, Alkalinity, Hardness (Water), Magnesium, Calcium, Leaves. Identifiers: "Montane streams, "Mineral content, Sample preservation, Macroinvertebrates, Flatworms, Autotrophy, Sampling methods, Sample preparation, Turbellaria, Goniobasis, Mountain laurel, Rhododendron, Dogwood trees, Tulip trees, Liriodendron, Phormidium, Calothrix breviarticulata, Lyngbya major, Debris, Potamogeton, Heteranthera, Mud plantain, Stigeoclonium lubricum, Cladophora glomerata. Stigeoclonium lubricum, Cladophora glomerata, Tuomeya fluviatilis, Macrophytes, Platyhelminthes, Bugs, Stenonema spp, Alderflies, Moths, Cymbella spp, Orb snails.

Nine montane streams in or near deciduous forests in eastern Kentucky and western Virginia were studied in relation to those factors involved in the level of autotrophism and benthos composition present. Samples of vegetation and macrobenthos were collected during each of several collecting trips and the water was analyzed for 02 (one time), alkalinity, hardness, Ca, Mg, inorganic P, amonia, and nitrite nitrogen. Algae and other plants were scraped or pulled from the bottom,

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Lirbanization

# Effects of Pollution—Group 5C

macrobenthos was taken with a Surber net from movable materials, submerged vegetation, and along bank overhangs, and naiad clams and fish were often picked up or caught by hand. Vegetation was preserved and stored in 2-4 percent formaldehyde solutions. Diatoms were later cleaned in acid and mounted in Hyrax.

Macrobenthos was fixed in formalin, washed with
water, sorted, and stored in alcohol. Parts for microslides were cleared in Euparol essence and nounted in diaphane. The streams fell into two distinct classes with respect to hardness and alkalinity - five with these values below 30 mgl (Type B streams) and four with them exceeding 50 mgl (Type A streams). B streams contained as much or more phosphorus and nitrogen as the A's, but had no vegetation other than very sparse algal growth, and, with one exception, lacked molluscs. Type A streams had abundant flowering plants and/or algae at all seasons and well-developed mollusc populations. Benthic insects also showed definite A and B characteristics, although the two stream types had a number of forms in common. Neither degree of shading nor stream size seemed primarily involved in scarcity of plants in B streams. Allochthonous debris was more concentrated in B streams. In one stream system the biota changed from B to A in character downstream mineral increase. (Holoman-Battelle)

OBSERVATIONS ON RED COLORED CELLS OF PERIDINIUM WISCONSINENSE EDDY FROM BUCKHORN LAKE, ONTARIO, Guelph Univ. (Ontario). Dept. of Zoology.

K. H. Nicholls.

Transactions of the American Microscopical Society, Vol 92, No 3, p 526-528, July 1973. 1 fig, 8 ref.

Descriptors: \*Dinoflagellates, Color, \*Life cycles, \*Phytoplankton, Aquatic algae, Pyrrophyta, \*Canada, \*Eutrophication, Microscopy, Pollutant identification, Seston.
Identifiers: \*Peridinium wisconsinense. Buckhorn

Lake (Ont.), \*Cell size, Flagellates.

Plankton samples taken from Buckhorn Lake, a eutrophic lake, revealed that Peridinium wisconsinense, widely distributed in the lake, exhibited a red coloration which masked the normal yellowish-brown pigment. The dimensions of 25 cells were recorded to determine a relationship, if any, between cell size and the red color. The red color of active cells in the plankton was not related to abnormally large cell size as has been believed for other species of Peridinium. Because the red color in active cells appears to be the result of preparation for encystment, it is suggested that P. wisconsinense has a cycle of encystment and excystment similar to that of P. cinctum f. westii. (Holoman-Battelle)

# TOXICITY BIOASSAY OF HEAVY METALS IN WATER USING TETRAHYMENA PYRIFORMIC

Texas Univ. Medical School, San Antonio. J. W. Carter, and I. L. Cameron. Water Research, Vol 7, No 7, p 951-961, July 1973. 9 fig. 3 tab, 7 ref.

Descriptors: \*Bioindicators, \*Heavy metals, \*Bioassay, \*Toxicity, \*Water pollution effects, Protozoa, Cultures, Mercury, Cobalt, Zinc, Lead, Cadmium, Water (Hardness), Water pollution, \*Lethal limit, Invertebrates.

Identifiers: \*Tetrahymena pyriformis, Synergistic effects, Median tolerance limit, Culture media.

The toxicities of five heavy metal compounds on the survival of the cilitated protozoan Tetrahymena pyriformis were determined. Threeday old cultured cells were exposed to five concentrations of each test compound in one or more of three water series; distilled, soft, and hard water. A culture of each sample was placed in a plastic petri dish and covered with mineral oil to prevent evaporation. The cells were counted initially, then again at 0.5 h, 1 h, 2 h, 1 day, 2 days, 3 days, and on the fourth day. Lethal threshold concentrations and tolerance limit medians were determined by graphic methods. On weight bases cadmium was most toxic, followed in decreasing toxicity by mercury, cobalt, zinc, and lead. Compared to similar fish data, all heavy metals were more toxic to T. pyriformis except lead. The toxicity of lead in soft versus hard water exemplified an antagonistic effect with greater than seven times the amount of lead necessary in hard water to produce comparable mortality as lead in soft water. On the other hand, the toxicity of mercury is about twice as great in hard water as in soft water (a synergistic effect). T. pyriformis appears to be a more sensitive indicator than fish of metal contamination of water. T. pyriformis bioassay should prove a good means of determining the existence of many water pollutants. (Holoman-W74-03321

ORGANIC NUTRIENT FACTORS EFFECTING

ALGAL GROWTHS, Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst

G. C. McDonald, N. L. Clesceri, I. J. Kumar, and W. J. Green.

Copy available from GPO Sup Doc as EP1.23:660-73-003, \$2.80; microfiche from NTIS as PB-226 877, \$1.45. Environmental Protection Agency, Ecological Research Series, Report EPA-660/3-73-003, July 1973. 302 p. 56 fig. 45 tab, 101 ref. EPA Project 16010 DHN.

Descriptors: \*Pollution abatement, Water quality control, \*Algae, Cyanophyta, Chlorophyta, Analytical techniques, Bioassay, Chromatography, Spectrophotometry, \*Bioassay, Chemical properties, Waste identification, Chemical wastes, Freeze-drying, Vacuum, \*Nutrients, Eutrophication, \*Organic wastes, \*Photosynthesis, \*Tertiary treatment, Thin films, Municipal wastes, \*New York.

Identifiers: Selenastrum capricornutum, Anabaena flos-aquae, \*Algal growth, Lake George (NY), Saratoga Lake (NY).

Effects of wastewater organic fractions on the growth rate of Selenastrum capricornutum and Anabaena flos-aquae were investigated. Effluent from a conventional activated sludge facility was membrane filtered, freeze-dried, and gel fractionated. Apparent molecular weights (AMW) were assigned to the appropriate fractions. These and organic carbon data showed 69% of the ef-fluent organics has an AMW less than 700. Absorbancies and regression analyses within algal exponential growth phases demonstrated the control growth rate for Selenastrum was 0.43 and for Anabaena was 0.34. Selenastrum growth rates were monitored using Lake George water as the diluent for the media employed. An inhibition in growth occurred. Halving the nitrogen concentra-tion in modified Gorham's had no significant effect on growth rate. In concentrating organics from natural water (Lake George and Saratoga Lake), raw sewage, and sewage effluent, thin film evaporation was preferred when using natural waters whereas freeze-drying was advantageous when working with sewage samples. Also, the soluble organic component in municipal wastewater was characterized and the effect of chemical-physical treatment on it has been shown. W74-03326

A STUDY OF BIOTROPISM OF CLIMATE IN TWO CANADIAN CITIES, Metagological Office, Poons (India)

Meteorological Office, Poona (India). B. Padmanabhamurty. Int J Biometeorol. Vol 16, No 2, p 107-117. 1972, Illus. Identifiers: Bronchitis, \*Canada, \*Cities, \*Climates (Biotropism), \*Human diseases, Neoplasm,

Climatic trends and effects on human health due to urbanization and industrialization of 2 Canadian cities during the last 30 yr were investigated. The frequency of thunderstorms, fog and smoke/haze days, cloud amount and dew point increased due to urbanization. Trends in mortality due to chronic bronchitis and neoplasm of the trachea, lung and bronchus suggest a positive effect of meteorological parameters.—Copyright 1973, Biological Abstracts, Inc.
W74-03478

ECOLOGICAL STUDIES ON DISSOLVED OXYGEN AND BLOOM OF MICROCYSTIS IN LAKE SUWA: I. HORIZONTAL DISTRIBUTION OF DISSOLVED OXYGEN IN RELATION TO DRIFTING OF MICROCYSTIS BY WIND, Shinshu Univ., Suwa (Japan). Suwa Hydrobiologi-

cal Station.

H. Yamagishi, and K. Aoyama. Bul Jap Soc Sci Fish. Vol 38, No 1, p 9-16. 1972. Il-

Identifiers: \*Dissolved oxygen, Distribution, Drifting, \*Ecological studies, \*Japan (Lake Suwa), Lakes, \*Microcystis bloom, Winds.

During the bloom season of Microcystis in Lake Suwa (Japan) the horizontal distribution of dissolved oxygen in surface waters was studied in relation to the drifting of the alga by winds. The studies demonstrated that dissolved oxygen in the lake increased from the windward to the leeward with concomitant increases in the density of drifting Microcystis and pH values: oxygen was markedly undersaturated on the windward (less than 50% saturation), but extremely supersaturated on the leeward (more than 250% saturation). Cell numbers of Microcystis reached 2.8 x 10 to the 8th power /ml at areas of highest density.—Copyright 1973, Biological Abstracts, Inc. W74-03524

# LAKE RESTORATION.

Compressed Air, Vol 78, No 10, p 11-16, 1973. 5 fig.

Descriptors: \*Oxygenation, \*Eutrophication, \*Reaeration, \*Hypolimnion, Nutrients, Water treatment, Oxygen, Algal control, Cold-water fish, \*New York, Trout.

Identifiers: "Hypolimnion aeration, "Lake restoration, Lake Waccabuc (N.Y.), Lake Oscaleta (N.Y.), Lake Rippowam (N.Y.), Aeration systems, Limno aerator.

Various methods for alleviating eutrophication are described and details given of a community action leading toward preservation of New York lakes Waccabuc, Oscaleta, and Rippowam in cooperation with the Union Carbide Corporation. Three sampling stations were selected in each lake where oxygen, temperature, pH, alkalinity, turbidity, conductivity, and chlorophyll concentrations were measured. The profiles for all three lakes are characteristic of moderate levels of eutrophication. To oxygenate the hypolimnion, two aerators were installed by helicopter with air hoses connected to an on-shore air compressor discharging at 280 cfm. Two cylinders were put down some 45 feet near the deepest points in Lake Waccabuc, which was selected as the deepest of the lakes and the farthest downstream. The other two lakes are being used as 'controls' for eventual evaluation of the hypolimnetic aeration effects. Several thousand trout were stocked in Lake Waccabuc and their movements are being monitored. Benefits of the aeration may not be realized fully until 1974 because there is a time lag between the

# Group 5C-Effects of Pollution

time the nutrients are regenerated in the hypolimnion and when they may become available to the algae during the maximum algal growth season. (Jones-Wisconsin) W74-03536

MATHEMATICAL MODELING OF EUTROPHI.

CATION OF LARGE LAKES, Manhattan Coll., Bronx, N.Y. Environmental En-gineering and Science Program.

. Thomann, D. M. DiToro, D. J. O'Connor, and R. P. Winfield.

Annual Report Year 1, April 1, 1972 - March 31, 1973. July 1973. 17 p, 10 fig. EPA R-800610.

Descriptors: \*Mathematical models, \*Eutrophica-tion, \*Lakes, \*Lake Ontario, Phytoplankton, Trophic level, Grazing, Predation, Settling velocity, Mixing, Zooplankton, Kinetics, Epilimnion, Hypolimnion, Benthos, Chlorophyll, Nitrogen, Phosphorus, Cycling nutrients, Data collections, Stratification, Carbon, Great Lakes. Identifiers: Large lakes, Interactive systems.

Modeling strategy developed for structuring the overall framework for study of Lake Ontario (and applicable to other large lakes) called for preparation of a preliminary model with emphasis on in-teractive kinetics of major eutrophication components. The resultant Lake 1 model is divided into two broad areas consisting of biological and chemical-biochemical sub-models. Interactions shown are both linear and non-linear. Detailed mathematical expressions are written for each system and interaction. The ten systems and the three spatial segments result in a total of 30 simultaneous non-linear differential equations to be solved. Several runs have been made using the Lake I model structure for the purposes of testing program elements, study behavior of the system and its sensitivity to various system parameters and inputs, and to prepare a preliminary verification of the model using data collected earlier. The model examined several areas including: variable levels of spring and fall vertical mixing, settling velocities for phytoplankton, zooplankton grazing rate, and zooplankton and higher-order predation using up to four trophic levels. The model is compared with observed data and indicates that some major features of phytoplankton and nutrient behavior can be reproduced and it provides a basis for extension to more detailed spatial computa-tions. (Jones-Wisconsin) W74-03537

NITRATE AND NITRITE IN THE SURFACE WATERS OF TWO DELAWARE SALT MARSHES

Delaware Univ., Newark. Dept. of Biological Sciences.

For primary bibliographic entry see Field 05B.

LOWER WATER TEMPERATURES WITHIN A

STREAMSIDE BUFFER STRIP,
Forest Service (USDA), Asheville, N.C. Southeastern Forest Experiment Station. For primary bibliographic entry see Field 04C. W74-03551

HEAVY METALS IN THE SEDIMENTS OF THE DANUBE, EMS, WESER AND ELBE RIVERS IN WEST GERMANY, (IN GERMAN), Heidelberg Univ. (West Germany). Laboratorium

fuer Sedimentforschung.
For primary bibliographic entry see Field 05B.

W74-03552

DELAYED RECOVERY OF A MESOTROPHIC LAKE AFTER NUTRIENT DIVERSION. Richland, Battelle-Pacific Northwest Labs., Wash

R. M. Emery, C. E. Moon, and E. B. Welch.

Journal Water Pollution Control Federation, Vol. 45, No 5, p 913-925, May 1973. 6 fig. 2 tab, 23 ref.

Descriptors: \*Nutrients. \*Diversion. water (Pollution), Mesotrophy, Surface waters, Trophic level, \*Eutrophication, Phosphorus, Dissolved oxygen, Primary productivity, Bioassay, Nitrates, Nitrites, Phytoplankton, Deficient ele-ments, Seston, Cyanophyta, Turbidity, \*Washing-

iton.
Identifiers: \*Lake Sammamish (Wash), Recovery,
I ake Washington, Data interpretation, Lake Washingto Chlorophyll a, Orthophosphates, Transparency.

Limnologic conditions in Lake Sammamish (Washington) before an abrupt reduction of nutrient income (by way of wastewater diversion) are compared to those present in Lake Washington (Washington) before diversion. Lake Sammamish was relatively less enriched and eutrophied than was Lake Washington before diversion. The response of Lake Washington to nutrient diversion was shown by Edmondson to be prompt and complete and the actual time required for amelioration was approximately the same as the estimated recovery time using the Vollenweider lake recovery model. Lake Sammamish, with about the same estimated time for recovery, has shown no significant amelioration since nutrients were diverted in September, 1968. This lack of response may be related to morphometric and hydrologic characteristics, but other undetermined aspects of the lake and its treatment application may be preventing Lake Sammanish from recovering as quickly as Lake Washington. (Holoman-Battelle) W74-03560

THE CHIRONOMIDS OF THE PERIPHYTON IN THE YUGOSLAV PART OF THE RIVER DANUBE (DIE CHIRONOMIDENFAUNA AUS DEM PERIPHYTON IN DER JUGOS-LAWISCHEN DONAUSTRECKE), Institute for Biological Research, Belgrade (Yu-

goslavia). For primary bibliographic entry see Field 05A. W74-03562

FISHES AS INDICATORS OF WATER OUALI-FISHES AS INDICATORS OF WATER QUALI-TY AND THEIR SIGNIFICANCE FOR ECONOMIC USE (FISCHE ALS INDIKATOR DER GEWASSERGUTE UND IHRE BEDEU-TUNG FUR DIE WASSERWIRTSCHAFTLICHE NUTZUNG), Institute for Biological Research, Belgrade (Yu-

goslavia). For primary bibliographic entry see Field 05A.

W74-03563

IODIDE OXIDATION BY A MARINE BACTERI-

Technion - Israel Inst. of Tech., Haifa. Dept. of Food Engineering.
For primary bibliographic entry see Field 05A.
W74-03565

COMPETITIVE GROWTH OF SEWAGE OR-

GANISMS, Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering. C. P. C. Poon, and K. K. Wang.

Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol 99, No EE4, p 489-498, August 1973. 3 fig, 1 tab, 14

Descriptors: \*Sewage bacteria, \*Fungi, \*Water temperature, Cold resistance, Urban runoff, Asphalt, \*Growth rates, \*Competition, \*Sodium chloride, Water pollution effects, Chlorides, Cultures, Bioassay, Growth rates, Dominant organ-isms, Chemical oxygen demand, Biochemical ox-ygen demand, Respiration, Environmental effects, wage treatment

Identifiers: \*Geotrichum candidum, Street salt.

Because of the occasional overgrowth of Geotrichum candidum in the Field Point Sewage Treatment Plant (Providence, R.I.) especially during winter, studies were undertaken to determine whether certain environmental factors, particularly street runoff, might give this fungus a comlarly street runort, might give this rungus a competitive advantage over sewage bacteria. Growth characteristics of sewage bacteria and Geotrichum were compared by the Warburg respirometric technique under identical conditions when exposed to simulated salted snow melt at 10 and 20 C. The snow melt contained chloride ion concentrations of 6000 at 10 000 are in the salter of the contained chloride ion concentrations of 6000 at 10 000 are in the salter of the snown than the snown that the snown than the snown that the snown than the snown than the snown than the snown that the snown than the snown that the snown that the snown that the snown trations of 5,000 and 10,000 mg/l and asphalt (with and without ultraviolet irradiation) 5-500mg/l. As expected, all activities under control conditions at 20 C, including oxygen uptake rate, specific growth rate, and rate of COD removal, indicated that the sewage fungus was less competitive. How-ever, low temperature, slug doses of chloride ion at 5,000 mg/l and 10,000 mg/l concentrations, and the presence of ultraviolet irradiated asphalt were found to affect differently the growth of activated sludge and Geotrichum. Individually or in comshudge and describing individually of michi-bination, these factors significantly reduced the growth activities of activated sludge while Geotrichum was much less affected under the same environment. It is concluded that such fac-tors in combination with low pH and high carboyhdrate content in sewage could cause a predominance of sewage fungus in treatment plants. (Little-Battelle) W74-03567

EFFECTS OF PESTICIDES ON EUGLENA GRACILIS. I. GROWTH STUDIES, Kearney State College, Nebraska, Biology De-

A. E. Poorman.

Bulletin of Environmental Contamination and Toxicology, Vol 10, No 1, p 25-28, July 1973. 3 tab,

Descriptors: \*Bioassay, 2 4-D, 2 4 5-T, Aldrin, DDT, \*Growth rates, Water pollution effects, \*Pesticide toxicity, Inhibition, Inhibitors, Euglena.

Identifiers: \*Organic solvents, Malathion, Methoxychlor, \*Euglena gracilis, Parathion. Ethanol, Acetone.

Euglena gracilis was grown for one week in a 250ml flask, the cells counted with a hemacytometer, and 9-ml aliquots distributed to culture tubes to study the effects of 2,4-D, 2,4,5-1, Aldrin Ac-10, DDT, Malathion, Parathion, and Methoxychlor on growth. Cells were also exposed to 95 percent ethanol and a 1 to 1 mixture of ethanol-acetone which were used to prepare the pesticide solu-tions. Tests were conducted for 24 hours with extions. Tests were conducted for 24 hours with exposures of 100, 50, 10, 5, or 1 ppm pesticide and 1.0 percent solvent, and for seven days with 100, 50, and 10 ppm pesticide. Each experiment was conducted 5 or more times, and the cell numbers averaged for each series. The 24-hour tests show that the solvents had little effect on the cells, and that the solvents had little effect on the cells, and in most cases 50 and 100 ppm of the pesticides significantly reduced growth with 2,4-D and 2,4,5-T being the most inhibitory. Concentrations of 10 ppm or less stimulated growth. The 7-day tests show that only the herbicides (2,4-D and 2,4,5-T) reduced growth and that only at the highest concentration. All other exposures stimulated growth. Further tests to study morphological alteration of cells which occurred with exposures to 50 and 100 ppm 2,4-D and 2,4,5-T showed that the effects were temporary. It is concluded that these pesticides are not a threat to Euglena since the concentrations required to inhibit growth are unlikely to occur in nature. (Little-Battelle) W74-03571

INHIBITION OF ACTIVE CHLOROPHENOL RED TRANSPORT IN GOLDFISH (CARASSIUS AURATUS) RENAL TUBULES, Union Coll., Schenectady, N.Y. Dept. of Biologi-

cal Sciences.

P. A. Gruppuso, and L. B. Kinter.

Bulletin of Environmental Contamination and Toxicology, Vol 10, No 3, p 181-186, September 1973. 2 fig, 1 tab, 15 ref.

Descriptors: \*Animal metabolism, \*Inhibition, \*DDT, Absorption, \*Bioassay, DDE, DDD, Organic compounds, Inhibitors, Cultures, Pesticide toxicity, Biochemistry, Mode of action, Enzymes. Identifiers: Transport, \*Chlorophenol red, \*Goldfish, DDA, Kidneys, Biological samples, Carassuis auratus, p-Aminohippurate, Iodopyracet, 2 4-Dinitrophenol.

Kidneys were excised from goldfish, placed in modified Forster's saline medium, teased with tweezers into loose masses of tubules, and about 0.5 mg placed in each depression of a multiple ceramic-ring slide. After removal of adhering medium, about 0.1 ml of medium containing 0.00002 M chlorophenol red was added. DDT and its metabolites, DDD, DDE, and DDA were added to investigate their effect on epithelial cell transport of organic anions such as phenol red. Incubation was carried out for up to 3 hours in a moist chamber at 18-20 C. Every 15-30 minutes, depression slides were removed, the media drawn off and replenished, and the teased masses evaluated for dye uptake. An arbitrary visual rating on a 1 to 5 color scale was made for the functioning tubules. the ratings for comparable depressions averaged, and dye-uptake curves generated using a least squares, curve-fitting computer program. To validate the method, dose-response data were also obtained for two known competitive inhibitors, PAH (p-aminohippurate) and Diodrast (iodopyracet), and the metabolic uncoupler, DNP (2, 4-dinitrophenol). DDT and its non-polar metabolites, DDD and DDE, were clearly inhibitory at 0.0001 M. The polar metabolite, DDA, appeared to be a more effective inhibitor than DDT. The rapidity of the inhibition indicates that metabolic conversion of DDT is not required for the inhibition. Three mechanisms are proposed which may underly the toxicity of DDT and like compounds. (Little-Battelle) W74-03573

OBSERVATIONS ON THE ECOLOGY AND DIS-TRIBUTION OF THE TURBELLARIAN FAUNA OF THE DANUBE DELTA (BEOBACHTUNGEN UBER DIE OKOLOGIE UND VERBREITUNG TURBELLARIENFAUNA IM DONAU-DELTA), Bucharest Univ. (Romania). Faculty of Biology.

V. Mack-Fira, and M. Cristea-Nastasescu Archiv fur Hydrobiologie, Suppl 44, No 2, p 266-268, March 1973. 2 ref.

Descriptors: \*Ecology, \*Ecological distribution, Aquatic habitats, Aquatic animals, Speciation, Systematics, Aquatic environment, Estuarine environment, Salt tolerance, Heat resistance. Identifiers: \*Turbellaria, \*Danube delta, Flatworms, Platyhelminthes, Eurytopic organisms, Catenula lemnae, Stenostomum unicolor, Stenostomum leucops, Microstomum lineare, Castrella truncata, Microdalyellia tennessensis europaea, Gieysztoria virgulifera, Typhloplana viridata, Strongylostoma radiatum, Stroncirratum, Papiella otophthalma, lingua, Mesostoma productum, Mesostoma Bothromesostoma personatum, Gieysztoria expedita, Gieysztoria triquetra, Oligochoerus, Mesostoma ehrenbergi, Olisthanella, Phaenocora.

An account is given of the turbellarian fauna of the three main regions of the Danube Delta: river, river-marine and predeltaic. Eurytopic, euryhaline and eurythermal species could be distinguised. The Turbellaria of the Danube Delta are, with few exceptions, wide-spread in other Rumanian inland waters. (Holoman-Battelle) W74-03574 COMPLEXING CAPACITY OF NATURAL WATER - ITS SIGNIFICANCE AND MEASURE-

MENT, Dept. of Environment, Burlington (Ontario). Centre for Inland Waters. For primary bibliographic entry see Field 05A.

THE EFFECT OF DISCONTINUOUS METHANOL ADDITION ON THE GROWTH OF A CARBON-LIMITED CULTURE OF PSEU-

Imperial Chemical Industries Ltd., Billingham (England). Agricultural Div.

J. D. Brooks, and J. L. Meers. Journal of General Microbiology, Vol 77, No 2,p 513-519, August 1973. 3 fig, 20 ref.

Descriptors: \*Pseudomonas, \*Growth rates, Hydrogen ion concentration, Dissolved oxygen, Carbon dioxide, Amino acids, Centrifugation, Specific gravity, Chromatography, Fermentation, \*Cultures, Methodology, Identifiers: \*Methanol, Continuous cultures,

Pseudomonas methyltropha, Fermenters.

A study was undertaken to investigate an earlier observation that regular oscillations in pH and DO tension occurred in carbon-limited cultures of Pseudomonas methylotropha growing continu-ously at low dilution rates. These oscillations occurred with the same frequency as the addition of the methanol carbon source. P. methylotropha was isolated from soil and maintained on methanol agar slopes at 37C. The continuous culture equipment used allowed the mode of addition methanol and nutrient salts solutions to be altered in four ways. As the interval between methanol additions was increased beyond 20 s the yield of bacterial dry wt/g of methanol fell significantly. Discontinuous methanol additions also caused cycling in the values of a number of parameters, including pH, dissolved oxygen tension, CO2 production and amino acid pool concentration. It is suggested that after each addition of methanol a burst of growth occurred, followed by a period of starvation. These observations are discussed in the light of continuous culture practice and theory. The results challenge established theories of how bacteria grow in continuous cultivation devices. If organisms growing in the apparatus that is normally used by microbiologists are in fact growing discontinuously, with bursts of growth happening with a regularity that depends on the imposed dilu-, than the explanations offered by many authors for variations in different phenomena with 'growth rate' must be reconsidered. (Mortland-Battelle) W74-03584

DIBUTYL- AND DI- (2-ETHYLHEXYL)PHTH-ALATE IN FISH,

Food and Drug Directorate, Ottawa (Ontario).
Food Research Labs.
For primary bibliographic entry see Field 05A.

W74-03590

EFFECT OF POLLUTION ON THE BLOOD CHARACTERISTICS OF TILAPIA ZILLII G., Alexandria Univ., (Egypt). Dept. of Oceanog-

M. A. H. Saad, A. Ezzat, and M. B. Shabana Water, Air, and Soil Pollution, Vol 2, No 2, p 171-179, June 1973. 2 fig, 2 tab, 30 ref.

Descriptors: \*Water pollution effects, \*Dissolved oxygen, Fish, \*Bioassay, Pesticides, Fertilizers, Lakes, Brackish water, Industrial wastes, Organic matter, Mortality, Coagulation, Proteins, Toxici-ty, Fish physiology, Fishdill, Cichlids. Identifiers: \*Tilapia zillii, Blood, \*Egypt (Lake

Mariut), Leucocytes, Erythrocytes, Haematocrit, Hemoglobin, Albumin, Globulin, Serum, Creatinine, Blood sugar, Biological samples, Body

Lake Mariut, a shallow brackish water basin neat Alexandria (U.A.R.) was a highly productive lake; however, it now receives large quantities of poll tants resulting in greatly reduced or depleted DO. The extremely low 02 content of the lake water has had hazardous effects on fish. Tilapia zillii G., which constitute a major part of the Egyptian lake fisheries, were sampled from Lake Mariut in order to study the effect of 02 deficiency on the blood characteristics of these fish. Under the stress of asphyxia, Tilapia showed a considerable increase in all blood constituents. The erythrocytes of asphyxiated Tilapia were characterized by a smaller corpuscular volume and a higher mean corpuscular hemoglobin count. A marked increase in total proteins, alpha globulin, glucose and creatinine was observed in asphyxiated fish. The results obtained from the experimentally asphyxiated fish and fish sampled from the 02 deficient area of Lake Mariut are nearly similar. It can be concluded that when the fish enters this 02 deficient area it begans to undergo asphyxiation, after which it may die. (Mortland-Battelle)

CARBON DIOXIDE AND PH: EFFECTS ON SPECIES SUCCESSION OF ALGAE.

Woods Hole Oceanographic Institution, Mass.
J. C. Goldman, and J. Shapiro.
Science, Vol 182, No 4109, p 306-307, October 19,

Descriptors: \*Limiting factors, \*Dominant organisms, \*Carbon dioxide, \*Hydrogen ion concentration, \*Succession, Growth rates, Nutrients, \*Cyanophyta, Enzymes.

Arguments are presented to refute Shapiro's hypothesis (see W73-08249) that predominance of blue-green algae results from a lowering of aqueous C02 concentration as the pH rises in natural waters. Three objections are presented: (1) that algal growth is not controlled by free C)2 concentrations, (2) that the pH can affect the availability of nutrients other than CO2, and (3) that the result or nutrients other than CO2, and (3) that the result of changing the pH may be through its effects on algal enzymes that may be involved in nutrients transport. Shapiro's responses to these objections are also presented. (Little-Battelle) W74-03594

TOXICITY OF LEAD NITRATE TO ALGAE, State Univ. Coll., Plattsburgh, N.Y. Dept. of Biological Sciences.

Water, Air, and Soil Pollution, Vol 2, No 2, p 181-190, June 1973. 2 fig, 5 tab, 19 ref.

Descriptors: \*Toxicity, Lead, Aquatic environ-ment, \*Nitrates, \*Algae, Anabaena, Chla-mydomonas, Radioactivity techniques, Cultures, dioxide, Primary productivity, s, Phytoplankton, Bioassay, Carbon Ecosystems, Phytoplankton, Bioas Photosynthesis, Heavy metals, Aquatic algae. Identifiers: \*Lead nitrate, Culture m Ochromonas

The fixation of radioactive C was used to measure the toxicity of Pb (N03)2 to five species of freshwater algae. Portions of unialgal cultures were inoculated into low salt medium and were used to test all species at 10, 20 and 30 ppm Pb. This medium approximated the salt concentrations of natural aquatic environments. Three different cell weights were used for each concentration of Pb and for the control to determine a relationship between cell weight and toxicity. The concentration of Pb causing a 50 percent reduction of C-14labelled C02 fixation as compared to the control was called the ED sub 50 (median effective dose). was called the LD sub 30 (median effective dose). These values were extrapolated from graphs of ppm Pb vs dpm/mg dry cell weight. The ED sub 50 for three of the species tested (Anabaena, Chlamydomonas and Navicula) was between 15 and 18 ppm Pb. A desmid, Cosmarium, had an ED sub 50 of 5 ppm. This species has a higher surface:

# Group 5C-Effects of Pollution

volume ratio than the other species tested and this may account for its increased sensitivity. An ED 50 for Ochromonas was not obtained. Throughout this experiment the fixation of C-14labelled C02 increased with increasing Pb concentrations and is not readily explained. (Mortland-

W74-03595

DISTRIBUTION OF FORAMINIFERA NEAR POLLUTION SOURCES IN CHALEUR BAY, Bedford Inst., Dartmouth (Nova Scotia). For primary bibliographic entry see Field 05B.

DISSIMILATORY REDUCTION OF INOR-GANIC SULFUR BY FACULTATIVELY ANAEROBIC MARINE BACTERIA, Woods Hole Oceanographic Institution, Mass J. H. Tuttle, and H. W. Jannasch. Journal of Bacteriology, Vol 115, No 3, p 732-737, September 1973. 5 tab, 26 ref.

Descriptors: \*Marine bacteria, \*Sulfur, \*Reduction (Chemical), \*Anaerobic bacteria, \*Sulfides, Cultures, Proteins, Hydrogen ion concentration, Growth rates, Chromatography, Volumetric analysis, Fermentation, Microbial degradation. Identifiers: Sulfites, Thiosulfates, Tetrathionates, Trithionates, Bacterium paratyphosum, Nitrosomonas, Citrobacter, Desulfavibrio, Nitrosomona: Nitrobacter, Culture media, Substrate utilization.

Growth experiments were conducted utilizing newly isolated facultatively anaerobic marine bacteria for the purpose of demonstrating dissimilatory reduction of thiosulfate and sulfite. Three strains of the isolates, which resembled a thiobacilli-type bacteria, were used. Inorganic sulfur compounds other than sulfate, were anaerobically reduced in a basal salts medium in three patterns: (1) sulfite and thiosulfate were reduced to sulfide, and tetrathionate was reduced to thiosulfate; (2) tetrathionate was reduced to thiosulfate only; or (3) thiosulfate was reduced to sulfide only when pyruvate was the substrate. Comparison of anaerobic growth in the presence or absence of inorganic sulfur compounds indicated true dissimilatory reductions. Evidence that these reductions involve dissimilation of inorganic sulfur are (1) the failure of the bacteria to grow anaerobically in the absence of a reduced sulfur compound, or (2) the significant increase of anaerobic growth in the presence of a reduced sulfur compound. The observed increase may be an expression of increased growth rate, increased cell yield, or both. The reduction of tetrathionate by the isolates 12W and 16B appears to be consistent with that described for Bacterium paratyphosum-B and Citrobacter. Although none of the isolates was able to use sulfate as an electron acceptor, it is clear that assimilatory reduction of sulfate occurs when sulfate is the sole sulfur source in growing cultures. (Mortland-Battelle)

IN SITU EXPERIMENTAL INVESTIGATIONS OF THE BIOMASS PRODUCTION OF MICRO-ALGAE AND OF NATURAL ALGAL BIOCOENOSES IN FLOWING WATERS, (IN GERMAN).

Jena Univ. (East Germany). Biology Section.

W. Braune.

Int Rev Gesamten Hydrobiol. Vol 57, No 2, p 227-

Int Rev Gesamen rydrobolo. Vol 37, No 2, p 227-225. 1972. Illus. (English summary). Identifiers: Algae, \*Algal biocenoses, \*Biomas (Algae), Box, Chlorophyll, Filters, \*Germany (Thuringia), Methods, Nitrogen, Phosphorus, Pol-Scenedesmus-Obliquus, lution. Production, Seasons, Sewage.

A 'filter-box' method was utilized (using glass tubes closed with permeable membrane filters). This permits quantitative experiments for the first

hand sutdy of algal life under biotope-like conditions in flowing waters. Information is presented about further results of such investigations with regard to: the biomass production of a test alga (Scenedesmus obliquus) and natural river-water biocenoses respectively (comparisons of cell number, dry weight, chlorophyll, total N and total P) and the spontaneous development of algae and the biomass production of river-water samples during all seasons of the year: comparison of test points situated above and below the town of Jena (Thuringia, Germany). Also using this method, the deterioration of river water condition below the town became evident in that alpha-mesosaprobe alone dominated. Both the results of counts of organisms and of species, as well as the biomass of algae produced were distinctly higher above the than below it (in accordance with the conditions in the natural colonization of the biotope). The general coincidence of the biomass production in the filter -boxes with the natural behavior in the corresponding biotope speaks for the biotope-like character of these investigations. The box method provides better results than descriptive methods because it eliminates accidents and provides quantitative accuracy. The results of the filter-boxmethod are used to calculate rates of productivity, turnover and the evaluation of energy conversion .-- Copyright 1973, Biological Ab-

MARINE MAMMALS,

Ilniv., Wageningen (Netherlands). MERCURY-SELENIUM CORRELATIONS IN

Dept. of Toxicology. J. H. Koeman, W. H. M. Peeters, C. H. M.

Koudstaal-Hol, P. S. Tjioe, and J. J. M. de Goeij. Nature, Vol 245, No 5425, p 385-386, October 19, 1973. 1 fig, 2 tab, 15 ref.

Descriptors: \*Mercury, \*Toxicity, \*Correlation analysis, \*Marine animals, Statistical analysis, Water pollution effects. Identifiers: \*Methylmercury, \*Selenium, Dol-

phins, Porpoises, Seals (Animals), Biological samples, Detoxification, Liver, Brain, Data interpreta-

Data on Hg and Se concentrations in the livers of dolphins, porpoises, and common seals showed a strong correlation of these two elements (correla-tion coefficient of 0.932). Work in progress indicates a similar correlation for the brain. This result suggests that the correlation reflects a causal relationship between mercury and selenium in marine animals. Se may have a protective effect against the toxic action of Hg in these animals as has been found in rats and Japanese quails. Additional observations that Hg in seal liver and brain is tightly bound and could not be recovered in the form of methylmercury may support the suggestion that Hg and Se occur together in animal tissues and are associated to proteins by means of S. (Little-Battelle) W74-03603

EFFECTS OF HIGHWAYS ON SURFACE AND SUBSURFACE WATERS.

Southeastern Massachusetts Univ., North Dartmouth. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04C. W74-03607

THE ATYPICAL PHOSPHATE CYCLE OF ESTUARIES IN RELATION TO BENTHIC METABOLISM,

Univ., Kingston. Narragansett Rhode Island Marine Lab. H. P. Jeffries.

Narragansette Marine Laboratory Contribution No 44. p 58-68, August 1962. 3 fig, 2 tab, 13 ref.

Descriptors: \*New Jersey, Estuaries, \*Mixing, \*Nutrients, Phosphates, \*Seasonal, Nitrates, Hydrography, Bays, Temperature, \*Estuarine environments. Identifiers: \*Raritan Bay (NJ), Flushing.

This report describes the phosphate and nitrate cycles of Raritan Bay, NJ which due to a combination of natural and man-made influences, demonstrate aspects of estuarine nutrient dynamics with the clarity of a laboratory experiment. The characteristic summer increase in phosphate content of New England and Middle Atlantic estuaries, coincident with a sharp drop in the N03:P04 ratio, can be qualitatively explained with existing information. The phenomenon, obviously of extreme importance in understanding estuarine productivity, is a manifestation of seasonal changes in several rates, both physical and biological. The processes are not peculiar to estuarine systems, but they appear to exert a greater effect, arising from the fundamental properties of the environment, than in the open ocean. Data are not available to assess these rates quantitatively; only their relative importance can be inferred. (Sinha - OEIS) W74-03626

DYNAMICS OF PHYTOPLANKTON IN THE LOWER VOLGA AND THE MAIN CHANNELS OF ITS DELTA, (IN RUSSIAN), Akademiya Nauk SSSR, Moscow. Dept. of

General Biology. I. N. Voloshko

Gidrobiol Zh. Vol 8, No 3, p 28-33. 1972, Illus. Identifiers: Bacillariophyta, Channels, Chlorophyta, Chrysophyta, Cyanophyta, Delta, Diatoms, Dynamics, Euglenophyta, Greens, \*Phytoplankton, Pyrrophyta, Seasonality, \*USSR (Volga River).

The distribution of Bacillariophyta, Chlorophyta, Cyanophyta, Pyrrophyta, Euglenophyta and Cyanophyta, Pyrrophyta, Euglenophyta and Chrysophyta in the lower Volga and its delta (USSR) was studied in the spring, summer and autumn of 1964, 1968 and 1969. Under conditions of substantial flow diatomaceous predominated; blue-green and green algae were present in smaller, but significant, quantities. Three zones in the main channel were delineated according to species distribution and quantity. The middle portion of the main channel before the delta was most productive. Phytoplankton were relatively scarce in the upper region near the dam. Seasonal variations in each region are discussed. With substantial flow rates vertical distribution was relatively even .-- Copyright 1973, Biological Abstracts, Inc. W74-03646

STAGNANT SEA.

S.H. Fonselius. Environment, Vol 12, No 6, p 6-11, 40-48, July-August 1970. 5 fig, 2 tab, 5 photo, 20 ref.

\*Water pollution, \*Eutrophication, \*Salinity, \*Oxygen, Anaerobic condition, Organic wastes, Sewage, Oil pollution, Radioactive wastes, Pesticides, Nutrients, Water properties, Industrial wastes, Viruses, Bacteria, Dissolved oxygen, Stagnant water, Water pollution effects. Identifiers: \*Baltic Sea.

The Baltic Sea is generally considered to be a stagnant basin, a semi-enclosed sea area with a restricted oxygen supply to the deep water, caused by narrow and shallow connections to the ocean and the existence of a light surface water layer which isolates the deep water from oxygen exchange with the atmosphere. Due to poor water circulation, most of the oxygen remains in the surface layer, while dead plants and animals sink to the bottom. In the deep water, anaerobic bacteria produce hydrogen sulfide, ammonia and nitrogen. When the deep water does mix with the surface

water, the large quantities of inorganic nutrients support algae which proliferate, die and cause depletion of the oxygen essential to marine life. The problem is aggravated in the Baltic area by the enormous amounts of urban and industrial wastes discharged into the sea. In some countries pipelines have been constructed to protect nearshore areas from sewage pollution, but these effluents may be harmful to fisheries in areas with restricted water exchange. Heavy concentrations of marine algae, cuased by eutrophication through pollution, as well as viruses and bacteria harmful to man have been found in some coastal areas. (Ritchie-Florida) W74-03712

#### READILY HYDROSABLE ORGANIC MATTER IN BOTTOM SEDIMENTS OF LAKE BAIKAL, (IN RUSSIAN).

L. A. Vykhristyuk, and F. I. Lazo. Izv Sib Otd Akad Nauk SSSR Ser Biol Med Nauk. 2 p, 59-63. 1972. Illus. (English summary). Identifiers: \*Bottom sediments, Lakes, \*Organic carbon (Hydrolyzable), \*USSR (Lake Baikal),

The content of readily hydrolyzable organic C in bottom sediments of the central part of the North Baikal (USSR), ranges 0.5-0.1%, N 0.04-0.08%. In the Middle and South Baikal these values range from 1.0-2.0 and 0.77-0.20%, respectively. In delta areas the concentration of movable organic matter is decreased in some cases as compared to adjacent open areas and increased in the others. Peculiarities of the distributions of readily hydrolyzable organic matter in surface layer of sediments is determined by unequal conditions of sedimentation and disintegration in the deposits of open Baikal regions and delta zones. In the sediment thickness regular decrease in the content of readily hydrolyzable organic matter is noted. On the whole, organic matter of the sediments studied contains sufficient accumulation of easily utilizable organic matter, which determines the intensity of biological processes .-- Copyright 1973, Biological Abstracts, Inc. W74-03715

STUDY OF A POLLUTED ENVIRONMENT (THE OLD PORT AREA OF MARSEILLES): THE INFLUENCE OF PHYSICAL AND CHEMI-CAL CONDITIONS ON THE CHARAC-TERISTICS OF THE POPULATION OF THE QUAY, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Sta-

tion Marine d'Endoume.

D. Leung Tack Kit.
Tethys. Vol 3, No 4, p 767-825. 1971 (1972). Illus. (English summary).

Identifiers: Carbon, Chemical conditions, Detergents, \*France (Marseilles), Nitrogen, Nutrients, Physical conditions, \*Polluted environment, Population, Ports, \*Quay, Salinity, Seston, Temperature, Dissolved oxygen.

The seasonal changes of several hydrological factors (temperature, dissolved oxygen, salinity, nutrients, seston, particulate C and N, detergents), and their influence in the fauna and flora of the quay were studied. The hydrological data show the circulation in the 2 basins, the undersaturation of dissolved oxygen in the harbor water, its freshening and its important reserve of nutrients. These conditions are favorable to substantial plankton production. The great quantity of organic material maintains the biological degradation by an 'autopollution.' The quay settlement is composed of an association of species resistant to extreme conditions and variations of the environment .-- Copyright 1973, Biological Abstracts, Inc. W74-03719

### **5D. Waste Treatment Processes**

REMOVAL OF PHOSPHATE FROM WASTE WATER BY ALUMINUM AND IRON, PHASE

Rutgers - The State Univ., Nee Brunswick, N.J. Dept. of Soils and Crops. P. H. Hsu.

Available from National Technical Information Available from National Technical Information Service as PB-226 878; \$4.00 in paper copy, \$1.45 in microfiche. New Jersey Water Resources Research Institute, Rutgers - The State University of New Jersey, Completion Report, November

Descriptors: Phosphates, \*Waste water treatment, \*Iron, \*Aluminum, \*Chemical precipitation, n, \*Aluminum, \*Chemica gulation, Chemical reactions. differs: \*Phosphate remo

Identifiers: \*Phosphate removal, Aluminum phosphate, Iron (III) phosphate.

Research has been carried on the chemical processes involved in the removal of phosphate from wastewater by compounds of aluminum and iron. Three subjects were investigated. The results are summarized as follows: (1) Effect of order of reactants mixing on the effectiveness of phosphate precipitation. A mere change in the order of reac tants mixing resulted in different effectiveness of phosphate precipitation in many, but not all, cases. After prolonged analysis a working hypothesis has gradually been taking shape. (2) Effects of calcium and sulfate on the precipitation of phosphate using iron (III). The effectiveness of phosphate precipitation using iron (III) was greatly improved on the alkaline side of the optimum region by the addition of calcium and on the acidic side by the addition of sulfate. When both calcium and sulfate were present, phosphate was effectively precipitated over a wide range of pH varying from 2.6 to above 8. In addition, a two-step process has been developed for removing phosphate from solution. The consumption of coagulant for highphosphate waste water can be greatly reduced with this proposed two-step process. Further investigation is being carried out to determine economic feasibility. (3) Aging of Fe3+ solutions. The results suggest that the size of colloidal iron (III) hydroxide greatly varies with the initial iron (III) concentration and acidity. The variation in particle size is the key factor governing the appearance and stability of hydrolyzed iron (III) solution. (See also W71-02272 and W72-13290) W74-03208

# TREATMENT OF DOMESTIC SEWAGE AT

OFFSHORE LOCATIONS,
Linfield and Hunter, Inc., Vicksburg, Miss.
G. G. Hebert, and R. D. Bryant.
In: Proceedings of 8th Mississippi Water
Resources Conference, April 10-11, 1973, p 99108, 1973. 2 tab, 7 ref.

Descriptors: \*Sewage treatment, \*Water pollution control, \*Offshore platforms, \*Gulf of Mexico, Marshes, Oil industry, Sewage disposal, Domestic wastes. Aeration, Methodology, Ecology,

Information is presented which describes the problems encountered in trying to provide adequate sewage treatment facilities for offshore platforms in the Gulf of Mexico. Until recently, the oil industry had not been confronted with the problem of having to provide sewage treatment facilities on its offshore platforms in the Gulf of Mexico or at its land based operations in the coastal marshes. However, in late 1970, with the advent of Federal regulation and the EPA, the increased activity of the Louisiana Stream Control Commission and the Department of Health in this area, and the issuance of OCS Order No. 8 by the United States Department of the Interior, Geological Survey, Conservation Division, Branch of Oil and Gas Operations, Gulf Coast Region, the necessity for sewage treatment became apparent. Packaged type extended aeration treatment units were selected for all offshore structures which had applied organic loads of sufficient magnitude to stain satisfactory performance of units having a minimum aeration tank size of 1500 gallons.
Marshland facilities were also provided with extended aeration plants when loading conditions
were suitable and conditions for the construction of stabilization ponds were unsuitable. (See also W74-03212) (Woodard-USGS) W74-03221

# DESIGN AND OPERATION OF LAND TREAT-

MENT SYSTEMS FOR MINIMUM CON-TAMINATION OF GROUNDWATER, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. H Ronwer

In: Underground Waste Management and Artificial Recharge, Vol 1, p 23-33, 1973. 5 fig, 10 ref.

Descriptors: \*Waste water disposal, \*Artificial recharge, Hydrogeology, Infiltration, \*Water reuse, Sprinkling, Biodegradation, \*Arizona. Identifiers: \*Land disposal (Waste water), Salt River Valley (Ariz).

The use of land treatment systems for sewage effluent and other liquid wastes, as well as some solid wastes, poses a threat to the quality of the native groundwater even though the waste water itself undergoes a marked improvement in quality as it moves through the ground and becomes renovated water. To avoid large-scale spread of the renovated water into the groundwater basin, the renovated water should be collected again at some point by wells or drains for reuse or release into the surface water. For the Salt River Valley of Arizona, the effective transmissibility of aquifer for recharge was evaluated from a pilot project and then used in the design of a full-scale system. This effective transmissibility was less than the aquifer transmissibility. (See also W74-03222) (Knapp-USGS) W74-03223

# SEDIMENT COLIFORM POPULATIONS AND POST CHLORINATION BEHAVIOR WASTEWATER BACTERIA.

Harris County Pollution Control Dept. Houston,

For primary bibliographic entry see Field 05A. W74-03295

# ORGANIC NUTRIENT FACTORS EFFECTING ALGAL GROWTHS, Rensselaer Polytechnic Inst., Troy, N.Y. Fresh

For primary bibliographic entry see Field 05C. W74-03326

#### NOMOGRAPHS FOR THERMAL POLLUTION CONTROL SYSTEMS,

Hittman Associates, Inc., Columbia, Md. C. L. Jedlicka

Copy available from GPO Sup Doc as EP1.23:660-73-004, \$1.80; microfiche from NTIS as PB-226 868, \$1.45. Environmental Protection Agency, Technology Series, Report EPA-660/2-73-004, September 1973. 171 p, 19 fig, 18 tab, 35 ref. EPA Project 16130 HKK. 68-01-0171.

Descriptors: \*Thermal pollution, \*Thermal power plants, Economics, \*Water cooling, \*Cooling towers, \*Cooling water, Costs, Annual costs, Capital costs, Cost analysis, Electric power costs, Water consumption, Water loss, Graphical methods, Curves, Mathematical studies. Identifiers: Cooling systems, Heat rejection systems, \*Nomographs.

# **Group 5D—Waste Treatment Processes**

Nomographs are presented and described which permit the estimation of heat rejection system per-formance, tower or pond capital and the perturbations to power plant efficiency and costs which result from the incorporation and operation of any one of the following thermal pollution control systems within a power plant as a substitute for once-through cooling: natural draft wet towers, mechanical draft wet towers, spray ponds, cooling ponds, and natural and mechanical draft dry towers. The base case plant for cost comparisons is chosen as having a nominal turbine back pres-sure of 2 in. Hg absolute. The total heat rejection system with its associated costs is defined to extend outward from the turbine exhaust flange, a common boundary for each of the systems me tioned above. Performance and capital costs for the thermal pollution control systems were compared with data from existing facilities and theoretical estimates from various sources. The theoretical estimates from various sources. The nomographs yield performance, water requirements and costs for heat rejection systems operating under design meteorological conditions and full load plant operation. Examples are presented to show how average annual water requirements from evaporation and average annual operating costs can be estimated. (EPA) W74-03329

ENRICHMENT OF MARSH HABITATS WITH ORGANIC WASTES,

Louisiana Water Resources Research Inst., Baton Rouge

W. G. Smith, and J. W. Day.

Available from the National Technical Information Service as PB-226 985, \$3.00 in paper copy, \$1.45 in microfiche. Completion Report, Nov. 1973. 7 p. 1 fig., 3 tab. OWRR A-033-LA (1).

Descriptors: \*Marshes, \*Land management, \*Nutrients, Recycling, \*Louisiana, \*Organic wastes, \*Water reuse, Soil analysis, Path of pollutants, Industrial wastes, Municipal wastes Identifiers: Dulac (La).

Municipal and industrial wastewater have created local problems, including eutrophication, plant nutrient loss, discharge-induced die-off of algal flora, and changes in chemical and biological character. Among methods used to solve these problems is that of overland runoff, and the project is an attempt to incorporate this method into an estuarine environment. A site in the subtropical coastal marsh at Dulac, Louisiana, home port facility for a menhaden processor, was selected: an artificially enclosed freshwater marsh, totaling about two and one-half square miles. Soil chemistry core samples were taken along the length of the marsh spoil apron every 75 ft. Measurements on extractable cations reveal the effects of continuous effluent application. Sampling stations for aquatic analysis, soil sampling, and microbial sam-pling are spaced at intervals from the points of wastewater discharge. Both general heterotrophic bacteria and proteolytic microbes are being measured at the same sites. The overall efficiency of land runoff in reducing the waste load should be reflected in the chemical oxygen demand and the total organic carbon at the sampling sites. (Alston-W74-03337

THE EFFECTS OF SURFACE IRRIGATION WITH DAIRY MANURE SLURRIES ON THE QUALITY OF GROUNDWATER AND SURFACE RUNOFF, Tennessee Univ., Knoxville. Dept. of Agricultural

Engineering.
For primary bibliographic entry see Field 05B. W74-03339

DAN REGION, ISRAEL, SEWAGE-RECLAM-ATION AND RECHARGE PROJECT, Tahal Consulting Engineers Ltd., Tel Aviv (Israel). Div. of Hydrology.

In: Underground Waste Management and Artificial Recharge, Vol 2, p 767-779, 1973, 6 fig. 1 tab.

Descriptors: \*Reclaimed water, \*Water reuse, \*Artificial recharge, \*Water spreading, Waste \*Artificial recharge, \*Water spreading, Water treatment, Waste water disposal, Mixing. Identifiers: \*Israel.

The effluent forecast of the Dan region of Israel in 1980 is estimated at more than 100 million cu m per year, and 175 million cu m in the year 2000. A sewage-reclamation recharge project was conceived to solve both environmental hazards and water-resources management problems and con-sists of 2 phases, sewage reclamation and recharge of the reclaimed sewage. The area occupied by the spreading grounds consists of sand dunes, for the most part overlying calcareous sandstones. These formations constitute the main aquifer of the re-gion. The reclaimed sewage will be spread al-ternately to allow the grounds to be dried and cultivated between recharge operations in order to remove the surficial crust and increase infiltration. It is estimated that the rate of percolation will be about 15 cm per day. An array of 30 production wells-drilled for the specific purpose of exploiting wells-drilled for the specific purpose of exploiting the recharged water-surrounds the spreading grounds. The water will be held in the subsurface for a period of 400 days, during which it will undergo natural filtration and mixing with existing groundwater. Following its subsurface movement and mixing, the reclaimed water will be pumped and converted to the National Water Courties for and conveyed to the National Water Carrier for transfer to the southern area of the country for supplementing irrigation requirements. (See also W74-03222) (Knapp-USGS) W74-03359

OPTIMIZING WATER USE: THE RETURN FLOW ISSUE.

Colorado Univ., Boulder. School of Lav For primary bibliographic entry see Field 06E. W74-03385

RECYCLING ON THE LAND: AN ALTERNA-TIVE FOR WATER POLLUTION CONTROL, Natural Resources Defense Council, Washington, D.C. Project on Clean Water. H. Boyer, and B. Reid. July 1973. 23 p, 1 biblio.

Descriptors: \*Land management, \*Waste water Descriptors: "Land management, "Waste water treatment, "Waste treatment, "Water treatment, "Water purification, Aquaculture, Infiltration, Percolation, Nutrients, Sewage effluents, Pollu-tants, Tertiary treatment, Public health. Identifiers: Spray irrigation.

Recycling on the land is the method of purifying sewage wastewater by applying it to the land. This method produces saleable crops, prevents the discharge of pollutants to waters and recharges the natural groundwater supply. Using wastes as resources in this manner should be considered by each communities in response to the Federal Water Pollution Control Act amendment of 1972 (Amendments). The land treatment process uses soil, air, plants and bacteria to purify waste water and is also referred to as 'spray irrigation'. Land treatment may also refer to aquaculture, the infiltration percolation method and the spray-runoff method. This publication focuses on the system on which the sewage is partially treated and sprayed on the land for the production of crops and the recycling of the nutrients which are contained in most sewage effluents. The Amendments set a goal of zero discharge of pollutants by 1985. Presently there are three competing forms of tertiary treatment: advanced biological, physical-chemical, and land treatment. Land treatment is a complex system which must be carefully planned and engineered to assure that the rate of applica-tion of treated wastewater conforms to local climate, soil, vegetative and geologic conditions. (Sears-Florida) W74-03387

SIMULATION OF A PETROLEUM REFINERY WASTE TREATMENT PROCESS, McMaster Univ., Hamilton (Ontario). Dept. of

Chemical Engineering.
T. W. Hoffman, D. R. Woods, K. L. Murphy, and

T. W. Mollman, D. R. V. D. D. Norman.
Journal of the Water Pollution Control Federation,
Vol 45, No 11, p 2321-2334, November 1973. 4 fig,
3 tab, 28 ref, 1 append.

Descriptors: \*Simulation analysis, \*Waste water treatment, Digital computers, \*Computer models, \*Treatment facilities, \*Industrial wastes, Computer programs, Equipment, Operation and main-tenance. Systems analysis.

The strategy and results are given for a steadystate material balance simulation of a modern wastewater treatment process at the BP petroleum wastewater treatment process at the BP petroleum refinery in Trafalgar, Ontario. The simulation, based on plant operating data and laboratory bench-scale experimeonts, uses the GEMCS executive program within a CDC 6400 digital computer. These executive programs use the modular approach whereby the processing sequence is viewed as a sequence of modules or units of equipment that are analyzed one at a time as opposed to simultaneously. The unique features of industrial waste treatment as compared with most chemical waste treatment as compared with most chemical and manufacturing processes, which make them difficult to simulate, are given. Dtails of each step in the strategy are presented: (1) defining objectives; (2) learning the process; (3) developing the stream list and information flow diagram; (4) preparing the models; and (5) using the simulation. The simulation duplicates normal operating conditions; data were not available for plant operation under different operating conditions and the model's predictions could not be tested fully. The simulation indicates that the strategy is valid and suggests the analyses of the components of the ams must be more fundamental. A combination of a plant testing and experimental research is required to provide a better understanding of the various units in the process. (Bell-Cornell)

A MATHEMATICAL MODEL FOR OPTIMUM DESIGN AND CONTROL OF METROPOLITAN WASTEWATER MANAGEMENT SYSTEMS, Battelle-Pacific Northwest Labs., Wash.

Water Resources Bulletin, Vol 9, No 6, p 1188-1200, December 1973. 6 fig, 2 tab, 11 ref.

Descriptors: \*Waste water treatment, \*Manage-Descriptors: "waste water treatment, "Management, "Simulation analysis, "Pynamic programming, "Water pollution control, "Urban runoff, "Sewers, "Overflow, Design, Optimization, Mathematical models, Systems analysis, Cities. Identifiers: Cleveland (Ohio).

The most economical approach to controlling untreated discharges in cities with combined sewers is to maximize utilization of the existing sewerage systems while minimizing the need for investment in system improvements and expansion. To determine the least-cost design and control, the wastewater management system must be analyzed in total. Presented is a comprehensive mathematical model (Urban Wastewater Management Model) developed to simulate continuously time-varying wastewater flows and qualities in complex metropolitan combined sewerage systems. Control optimization is accomplished using dynamic programming. The model serves three functions: (1) assessment of existing or planned system performance in relation to other wastewater discharges in either a metropolitan or river basin area; (2) determination of the optimum operation of existing or planned systems during rainstorms; and (3) determination of the most economically feasible combination of design alternatives for improving existing systems to meet specified per-formance criteria. The model provides an efficient engineering tool for evaluating and controlling pol-lutant discharges from combined sewerage systems to receiving waters, while considering time and spacial variations of rainfall and dryweather flows and qualities as well as economic constrants. (Bell-Cornell)

SUITABILITY OF FOOD PROCESSING WASTE WATER FOR IRRIGATION,
Agricultural Research Service, Norfolk, Va.

G. A. Pearson.
J Environ Qual, Vol 1, No 4, p 394-397, 1972.
Identifiers: \*Chlorides, Cucurbita-pepo-varmelopepo, Electrical conductivity, \*Food
processing wastes, Ipomoea-batatas, \*Irrigation,
Lycopersicon-esculentum, Phaseolus-lunatus,
Phaseolus-vulgaris, Pisum-sativum, Processing,
Salisitus, \*Sodium, Solenum thereous, Wester Salinity, \*Sodium, Solanum-tuberosum, Waste waters, Zea-mays, Chemical oxygen demand,

The waste water from food processing contains dissolved salts and organic matter. The amount of each depends upon the product being processed and the procedure being used. The suitability for irrigation of food processing waste water from 20 plants processing 9 food products was assessed from the standpoint of electrical conductivity (EC), chloride and Na concentrations, Na adsorption-ratio (SAR), and chemical oxygen demand (COD). Waste water from plants processing green beans (Phaseolus vulgaris L.), squash (Cucurbita pepo var. melopepo Alef.), tomatoes (Lycopersicon esculentum Mill.), corn (Zea mays L.), steam peeled potatoes (Solanum tuberosum L.) and sweet potatoes (Ipomoea batatas Lam.), and poultry is suitable for irrigation under most conditions. Waste water from some pea (Pisum sativum L.) and lima beans (Phaseolus lunatus L.) processing plants may be suitable for irrigation, but is of questionable suitability from others. Waste water from lye-peel potato processing is not suitable for irrigation.--Copyright 1973, Biological Abstracts, Inc. W74-03482

UPGRADING LAGOONS, Brown and Caldwell, San Francisco, Calif. D. H. Caldwell, D. S. Parker, and W. R. Uhte. Environmental Protection Agency Transfer Seminar Publication, August 1973. 20 fig, 10 tab,

Descriptors: \*Sewage treatment, \*Biodegradation, \*Sewage lagoons, \*Design criteria, Aerated lagoons, Waste water treatment, Treatment facilities, Oxidation lagoons, Tertiary treatment, Algal control, Odor, Biochemical oxygen demand, Aerobic treatment, Anaerobic digestion. Identifiers: Facultative ponds, Technology

Lagoons are one of the most commonly employed secondary waste treatment systems. Waste treatment lagoons can be divided into five general classes according to the types of biological transclasses according to the types of biological transformations taking place in the lagoon: high-rate aerobic ponds, facultative ponds, anaerobic ponds, maturation or tertiary ponds, and aerated lagoons. Operating problems include organic matter in effluents, odors, noxious vegetative growths, and seasonal performance variations.

Many of the techniques available for upgrading lagoons treating primary and secondary effluents have already been incorporated in designs at one or more locations -- often in the original construction and not as a modification. A well designed pond will incorporate physical features that minimize upsets, maintenance, and nuisances, and maximize operational flexibility, stability, and BOD removal. Physical design features that should be considered include configuration, recirculation, feed and withdrawal variations, pond transfer inlets and outlets, dike construction, supplementation of oxidation capacity and algae removal. Case studies of Sunnyvale Water Pollution Control Plant, Los Banos Sewage Treatment Plant, and Stockton Main Water Quality Control Plant are presented as examples of upgrading ponds. (Slattery-Wisconsin) W74-03495

OXYGEN ACTIVATED SLUDGE WASTE-WATER TREATMENT SYSTEMS: DESIGN CRITERIA AND OPERATING EXPERIENCE, Union Carbide Corp., Tonawanda, N.Y. Linde

Div E. A. Wilcox, and A. Thomas.

Environmental Protection Agency Technology Transfer Seminar Publication, August 1973. 46 p, 12 fig, 13 tab, 3 ref.

Descriptors: \*Waste water treatment. \*Activated sludge, \*Design criteria, Treatment facilities, Aeration, Oxygen, Water pollution control, Oxygenation, Economic feasibility, Pilot plants, Operations, \*Costs.

Identifiers: Unox system, Technology transfer, Air-activated sludge.

The use of oxygen instead of air in the activatedsludge process is one recent advancement in aiding pollution control. Three direct economic factors were given as reasons for selecting oxygen instead of air for the activated-sludge process. Higher mixed liquor solids under aeration can be main tained when using oxygen as the aeration gas, with occurrence of oxygen mass-transfer limitations. Concentrating the active biomass in a smaller volume reduces concrete tankage requirements, thus reducing costs. Higher oxygen-transfer efficiencies are made possible using oxygen as the aeration gas. These efficiencies lower equipment requirements for oxygen dissolution, with an attendant reduction in requirements for auxilary equipment, e.g. electrical switchgear. Power savings generally result from the higher oxygen mass-transfer efficiencies experienced in pure-oxygen processes. The power required to generate oxygen for the biological process added to that required for oxygen dissolution generally is less than that required to provide oxygen to a conven-tional activated-sludge process with air as the oxygen source. A comparative analysis between costs of using oxygen versus air in the activated-sludge process in four completed pilot-plant programs showed the costs to be consistently lower when oxygen was used. (Slattery-Wisconsin) W74-03496

PRETREATMENT OF POULTRY PROCESSING WASTES: UPGRADING POULTRY-PROCESSING FACILITIES TO REDUCE POL-LUTION

A. J. Steffen.

Environmental Protection Agency Technology Transfer Seminar Publication 2, July 1973. 59 p, 24

Descriptors: \*Poultry, \*Waste treatment, \*Treatment facilities, Pollution abatement, \*Costs, Industrial wastes, Sewage disposal, Pollution taxes (Charges), \*Waste water treatment, Cities. Identifiers: \*Poultry waste pretreatment, Sewer surcharges, Technology transfer.

Poultry waste pretreatment refers to the treatment of poultry wastes after the customary screening in flowaway systems and prior to discharge to a municipal sewer. The majority of poultry plants discharge to municipal sewers; whether pretreatment is required at a poultry plant frequently depends upon municipal regulations regarding some of the ingredients in the poultry wastes. Except for compulsory action to remove materials prohibited from entering city sewers, the degree of pretreat-ment is generally an economic decision and no simple set of parameters can be established because plants, and surcharges imposed by municipalities differ. Costs of pretreatment depend on factors such as size of the poultry plant, type of processing, space available for pretreatment, quality of in-house waste conservation, and pump-ing requirements. Types of poultry wastes pretreatment presented include: secondary screening only; secondary screening and separation of floatable and settleable solids by gravity, pressurized air flotation, or other means; separation of floatable and settleable solids as above, but without secondary screening; and secondary screening and separation of floatable and secondary screening and separation of floatable and settlea-ble solids, plus biological or chemical treatment for further BOD removal. (Slattery-Wisconsin) W74-03497

IN-PROCESS POLLUTION ABATEMENT: UP-

GRADING POULTRY-PROCESSING FACILI-TIES TO REDUCE POLLUTION, Environmental Engineering, Inc., Gainesville, Fla. R. H. Jones, J. D. Crane, T. A. Bursztynsky, J. A.

Macon, and J. E. Turner.
Environmental Protection Agency Technology
Transfer Seminar Publication 1, July 1973. 28 p, 2 fig. 5 tab. 6 ref.

Descriptors: \*Pollution abatement, \*Waste water treatment, \*Poultry, \*Industrial wastes, Consumptive use, Water management (Applied), \*Costs, Operation and maintenance, North Carolina. Identifiers: \*Poultry processing plants, Technolo-

The size and concentration of the poultry processing industry has caused concern in view of processing industry has caused concern in view of the industry's large volume of waste generation. In poultry processing feathers, blood, dirt, and viscera are removed from a product that must be made acceptable for human consumption. Large quantities of water are consumed in both washing and cleaning the poultry during processing and also in carrying away large amounts of wastes to screening and ultimate disposal. This study suggests ways water misuse can be prevented or corgests ways water insuse can be prevented or cor-rected. Some suggestions to improve water management include the stunning of carcasses electrically at slaughter to prevent body movement and splattering of blood, reuse of screened chiller water as scalder feed water, and reuse of screened reatner Itume water in the feather flume. The Gold Kist Case Study (Durham, N.C.) illustrates the impact of in-plant process and equipment changes on water use and waste abatement in poultry processing. Results of this study may be used to direct operation improvement of other poultry plants. (Slattery-Wisconsin) W74-03498 feather flume water in the feather flume. The Gold

WASTE TREATMENT: UPGRADING METAL-FINISHING FACILITIES TO REDUCE POLLU-

Lancy Labs., Inc., Zelienople, Pa.

L. E. Lancy, and R. L. Rice. Environmental Protection Agency Technology Transfer Seminar Publication 2, July 1973. 27 p, 6 fig, 1 tab, 25 ref.

Descriptors: \*Waste water treatment, \*Metals, \*Water pollution, \*Waste treatment, Water pollution control, Industrial wastes, Water reuse, \*Costs, Consumptive use.

Identifiers: \*Metal processing, Technology transfer, Sewer rental charges.

Metal processing in manufacturing includes a number of finishing steps that improve and condi-tion the surface for further processing for the intended final purpose of an article. Most of these finishing steps employ wet processes and require rinsing steps. Water pollution is caused by the deliberate or accidential discharge of the processing solutions and contaminated rinse water. Commonly used waste treatment systems are: batch treatment, continuous treatment, in-tegrated treatment, and non-exchange treatment.

# Group 5D-Waste Treatment Processes

Costs of waste treatment will depend on many factors. Waste treatment design should provide the hest treatment in view of the mounting restrictions anticipated in the future. Water consumption and sewer rental charges should be considered as much a part of the overall cost as the chemicals used in treatment. Savings achieved in water reuse opportunities and from chemical and metal recovery steps built into the waste treatment scheme may allow economies to offset treatment costs, reducing overall operating costs. Increasing the supervisory and operating labor costs can be avoided only if the waste treatment system is integral, or at least close, to the processing area. Previous studies have shown that suitable waste treatment design in many installations may signifi-cantly reduce operating costs. (Slattery-Wiscon-W74-03499

UPGRADING EXISTING WASTEWA TREATMENT PLANTS: CASE HISTORIES, Hazen and Sawyer, New York. WASTEWATER

Environmental Protection Agency Technology Transfer Seminar Publication, August 1973. 11 fig,

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Design data, Design standards, \*Costs, Trickling filters, Activated sludge, Waste treat-

Identifiers: \*Case studies, Hydraulic-retention time. Solids retention time. Technology transfer.

Upgrading the performance of activated sludge and trickling-filter plants can be accomplished through modification of biological processes. Factors that may limit performance to less than optimum are inadequate hydraulic-retention or contact time and solids retention time. Different ways of overcoming these types of inadequacies are discussed in several case studies. Study sites include South Buffalo Creek Wastewater Treatment Plant at Greensboro, N.C., Livermore Wastewater Treatment Plant at Livermore Calif., and the Wards Island Wastewater Treatment Plant in New York, N.Y. Plant upgrading costs are included. (Slattery-Wisconsin) W74-03500

HYDROGEOLOGIC CONSIDERATIONS IN LAND SPREADING OF SEWAGE TREAT-MENT-PLANT EFFLUENT IN CENTRAL CENTRAL

FLORIDA, Geological Survey, Winter Park, Fla. Water Resources Div.

F. A. Watkins.

In: Proceedings of the Land Spreading Conference at Orlando, Florida, July 15, 1971: East Central Florida Regional Planning Council, Winter Park, Florida, p 4-1--4-2, 1971.

Descriptors: \*Waste water disposal. \*Water reuse. \*Hydrogeology, \*Sprinkler irrigation, Irrigation water, Biodegradation, Surface-ground water relations, Infiltration, Water spreading. Identifiers: \*Spray irrigation, \*Land spreading

(Wastewater).

Disposal of waste water from sewage treatment plants in central Florida includes land-spreading techniques. Spreading also can be used to provide tertiary treatment resulting in disposal of an effluent that, under suitable hydrologic conditions and suitable treatment, should not adversely affect the quality of the water in the receiving environ-ment. Land disposal involves study of total thichness of clastic material overlying the aquifer; head relations between the water table aquifer and the aquifer: the surface drainage pattern and head relations between surface water and ground water; the ability of the root-zone soils to absorb and retain effluent for removal of nutrients by plants; the thickness and lithology of the unsaturated zone in relation to adsorption and transmission of water and ion-exchange capability; and the water-transmitting properties of the saturated zone, the direction of water movement in this zone, and ion exchange, adsorption, and chemical reactions. (See also W72-13704) (Knapp-USGS) W74-03518

RENOVATING SEWAGE EFFLUENT BY GROUND WATER RECHARGE, Agricultural Research Service, Phoenix, Ariz.

Water Conservation Lab.

H. Bouwer, J. C. Lance, and R. C. Rice. In: Proceedings of the Land Spreading Conference at Orlando, Florida, July 15, 1971: East Central Florida Regional Planning Council, Winter Park, Florida, p 6-1--6-20, 1971. 3 fig, 2 tab, 14 ref.

Descriptors: \*Water reuse, \*Waste water treat-ment, \*Artificial recharge, \*Tertiary treatment, Biodegradation, Waste water disposal, \*Arizona,

Water spreading.

Identifiers: \*Phoenix (Ariz), \*Spray irrigation, \*Land spreading (Wastewater).

A pilot project was installed in 1967 to determine if the tertiary treatment necessary to permit largescale reuse of sewage could be obtained effectively and economically by using infiltration basins in the normally dry Salt River bed. Phoenix, Arizona. The hydrogeological conditions of the Salt River bed (about 3 ft of fine, loamy sand underlain by sand and gravel layers to great depth and a groundwater table at about 10 ft depth) are favorable for high-rate waste water reclamation by groundwater recharge. The infiltration rate in grass-covered basins is 25% higher, and in a gravel-covered basin 50% lower, than in a bare soil basin. Alternating 2week inundation periods with 10-day dry-up periods yield an annual infiltration rate of about 400 ft. Reclaimed water, pumped from 30 ft depth in the center of the recharge area, has a biochemical oxygen demand of about 0.5 mg/liter (BOD of the sewage effluent is about 15 mg/liter) and a median fecal coliform density of 10 per 100 ml. Nitrogen is essentially all converted to the nitrate form in the reclaimed water. More nitrogen was removed under vegetated infiltration basins than under nonvegetated basins. Phosphate concentrations in the reclaimed water are around 5 ppm, as compared to 13 ppm in the effluent. (See also W72-13704) (Knapp-USGS) W74-03520

ENGINEERING DESIGN CRITERIA FOR SPRAY IRRIGATION, Bishop (William), Tallahassee, Fla.

W. M. Bishop.

In: Proceedings of the Land Spreading Conference at Orlando, Florida, July 15, 1971: East Central Florida Regional Planning Council, Winter Park, Florida, p 7-1--7-7, 1971.

Descriptors: \*Waste water disposal, \*Sprinkler irrigation, Tertiary treatment, Infiltration, Biodegradation, Waste water treatment, Water spreading, Florida.

Identifiers: \*Tallahassee (Fla), \*Spray irrigation, \*Land spreading (Waste water).

A municipal spray irrigation field is used for disposing of treatment plant effluent in Tallahassee, Florida. In the area where the irrigation fields were planned, the soil is very sandy. The design loading on the soil was based on the recommended loading on a relatively slow sand filter, 125,000 gallons per acre per day. The two fields are alternated daily allowing 24 hours resting. (See also W72-13704) (Knapp-USGS)

W74-03521

CLOSED WATER CIRCUITS IN A PAPER MILL PROCESSING WASTE PAPER,
Technische Universitaet. Darmstadt (West Ger-

recnnische Universitaet, Darmstadt (West Germany), Wasser- und Abwasserforschungsstelle. W. Brecht, and H. L. Dalpke. Available from IPC, Appleton, Wis. 54911. Price: \$5.00. Translated from Wochenblatt fuer Papierfabrikation, Vol 100, No 16, p 579-585, August 31, 1972. 17 p, 6 tab.

Lescriptors: \*Pulp wastes, \*Water conservation, \*Recycling, Pulp and paper industry, Europe, Effluents, Water circulation, \*Water reuse, \*Industrial water.

Identifiers: \*Germany, Paper machines, White water, Fourdrinier machines, Coarse papers, Packaging papers.

A German paper mill which manufactures corrugating medium, packaging papers, and similar coarse and low-grade papers utilizes two fourdrinier machines with completely closed water circuits which cause essentially no effluent during normal operation or during weekly cleanup schedules. The manufacturing scheme is described, including diagrams of the pulp stock and water circulation systems. Although the closure of the water system has increased the concentrations of solids in the white water with attendant corrosion and slime deposit problems, these difficulties are amenable to technological solutions. No adverse effect on either the quality or the quantity of paper products has been noted. (Speckhard-IPC) W74-03540

APPARATUS FOR AUTOMATIC CONTROL OF SEDIMENT LEVEL (PRIBOR DLYA AVTO-MATICHESKOGO KONTROLYA UROVNYA

OSADKA), Ukrainski Nauchno-Issledovatelskii Institute Bumagi, Kiev (USSR).

M. L. Gomberg, V. V. Zhikharev, and I. T.

Prilipko.

Bumazhnaya Promyshlennost', No. 2, p 24, February 1973. 2 fig, 1 tab.

Descriptors: \*Instrumentation, \*Automatic control, Water levels, \*Settling basins, Sedimenta-tion, \*Indicators, Treatment facilities, Effluents, \*Pulp wastes, Industrial wastes, Pulp and paper industry, Optical properties, Remote control, Valves, Gates, Pumps.

Identifiers: Level gages, \*Sediment level indica-

An indicator, designated 'SUO-1', for control of sediment levels in effluent-purification settling tanks is described. It operates on the principle of comparative light-scattering measurements of the sediment and the supernatant liquid layers. A beam from a light source reaches two photoresistors immersed in the two layers, respectively. Signals from these resistors are transmitted con-tinuously to a remote-control panel where they trigger mechanisms that adjust the operation of pumps and gate valves. The SUO-1 apparatus was tested in several kinds of sedimentation tanks at the Solikamsk and Baikal pulp and paper mills (USSR) and is recommended for general use in the Soviet paper industry. (Stapinski-IPC) W74-03541

EFFECT OF BARK ADDITION ON THE DE-WATERING PROPERTIES OF BIOLOGICAL

National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.

NCASI Stream Improvement Technical Bulletin, No. 261, December 1972. 41 p, 10 tab, 7 fig, 1 append, 18 ref.

Descriptors: \*Sludge treatment, \*Dewatering, \*Bark, \*Filtration, \*Vacuum drying, Sludge disposal, \*Pulp wastes, Incineration, Coniferous

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Waste Treatment Processes—Group 5D

trees, Deciduous trees, Particle size, Wood wastes, Pulp and paper industry, Activated sludge. Identifiers: Filter aids, Filter cake, Materials

A major problem of activated sludge treatment of industrial effluents is the difficulty of dewatering excess biological cell solids generated during biooxidation of organic pollutants. Addition of inorganic coagulants or organic polyelectrolytes al-leviates the problem only slightly. The dewatering of sludge mixtures is a function of the primary-tosecondary sludge ratio and of the amount of longfibered matter in the primary sludge. Incorpora-tion of bark particles (which are otherwise in-cinerated in steam generators) was found to facilitate sludge dewatering in vacuum filters; the resulting filter cake was readily pressed and burned in pulp mill power boilers. A detailed study of various bark types and particle sizes indicated that softwood bark was superior to hardwood bark, and that the 20-40 mesh fraction was the most effective. For satisfactory sludge handling, a bark-to-secondary sludge solids ratio of 3:1 was necessary. The bark functions essentially as an indepth filter aid, thus improving the porosity of the mixed sludge. Elimination of the 100-mesh fiber fraction reduced the bark's effectiveness, but still yielded an acceptable filter cake. (Witt-IPC) W74-03544

MILL WASTE TREATMENT BY FLOTATION

AT DELAIR, Georgia-Pacific Corp., Delair, N.J. M. Gould, J. Walzer, and H. Lundgren. Chem 26 -- Paper Processing, Vol 8, No 11, p 50-52, November 1972. 1 fig. 1 ref.

Descriptors: \*Pulp wastes, Pollution abatement, \*Waste water treatment, \*Suspended solids, Water pollution treatment, \*Treatment facilities, \*New Jersey, \*Flotation, Pulp and paper industry, Water quality control, Regulation, Capital cost, Filters, Filtration, Delaware River Basin Commission, Delaware River. Identifiers: Waste paper, Paper mills, Wallpaper.

At a cost of nearly \$500,000 (including preliminary test work and consulting fees), Georgia-Pacific Corp. installed a commercial air-flotation system for removal of suspended solids from effluents of its paper mill in Delair, New Jersey, which produces wallboard backings and facings entirely from recycled waste paper fibers. The installation followed an unsuccessful trial with disk filter savealls in 1967 and a pilot study of the air flota-tion process in 1970. The new system is said to meet water quality specifications of the Delaware River Basin Commission, the State of New Jersey, and the Army Corps of Engineers. (Witt-IPC) W74-03545

FOREST INDUSTRY'S ENVIRONMENTAL POLLUTION CONTROL IN FINLAND. THE FINNISH FOREST INDUSTRY'S WATER PRO-TECTION INVESTMENT PROGRAMME.

Finnish Paper and Timber, Vol 23, No 9, p 117-122, 125, 129, 1972, 1 tab, 5 illus.

Descriptors: \*Pollution abatement, Europe, \*Pulp and paper industry, \*Treatment facilities, \*Capital costs, Costs, Economics, Air pollution, Environmental control, \*Waste water treatment, Planning, Project planning, Investment, Water pollution Identifiers: \*Finland.

Investments for effluent treatment and water pollution control made by the Finnish pulp, paper, building board, and allied forest products industries amounted to 183 million Finnish marks in the 1960's (based on 1969 monetary value), 62.8 million marks in 1970/71, and approximately 200 mil-lion marks in 1972/73. About 450-500 million marks are likely to be spent in the first half of the 1970's, of which projects costing over 200 million marks have already been committed and approved by the Water Court. Air protection investments to date are estimated at ca. one-fourth of those required for water protection. Details are presented of the environmental protection installations accomplished and planned by several major Finnish pulp, paper, hardboard, and paperboard mills. (Witt-IPC) W74-03546

CONVENTIONAL TREATMENT METHODS FOR PULP AND PAPER MILL WASTES AND DISPOSAL ON LAND FOR IRRIGATION.

Central Public Health Engineering Research Inst., Nagpur (India).

Nagpur (India).

B. B. Bhalerao, and S. R. Alagarsamy.
Ippta (Journal of the Indian Pulp and Paper Technical Association), Vol 9, No 1, p 24-30, January-March 1972. 2 fig, 8 tab, 17 ref.

Descriptors: "Pulp wastes, "Waste water treatment, "Soil disposal fields, "Sewage treatment, Pulp and paper industry, Effluents, Industrial wastes, Liquid wastes, Land use, Filtration, Oxidation, Biological treatment, Filters, Trickling filters, Irrigation

Identifiers: Kraft mills, \*India.

A review of sewage treatment methods and equipment, such as biooxidation and trickling filters, led to the conclusion that conventional processes can be modified so as to adapt them to the treatment of pulp and paper mill effluents, such as combined kraft mill discharges. The parameters which must be considered before disposing the treated efand paper mill effluents, such as combined fluents on land are discussed, notably the characteristics of different effluents, the intended use of the soil (agriculture, forestry, etc.), and the soil's tolerance for various hydraulic and organic loadings. (Wise-IPC) W74-03547

PULP AND PAPER MILL WASTES TREATMENT; ALTERNATIVES AND COST ECONOMICS, COST

Central Public Health Engineering Research Inst., Nagpur (India).

S. R. Alagarsamy, and B. B. Bhalerao. Technical Association), Vol 9, No 1, p 40-48, January-March 1972. 12 fig, 9 tab, 3 ref.

Descriptors: \*Pulp wastes, \*Bleaching wastes, \*Waste water treatment, \*Comparative costs, \*Economic efficiency, Oxidation, Aerated lagoons, Oxidation lagoons, Lagoons, Industrial wastes, Effluents, Pulp and paper industry, Costs, Operating costs, Capital costs, Maintenance, Treatment facilities, Anaerobic digestion, Sewage treatment, Waste treatment. Identifiers: \*India.

Conventional sewage-treatment methods are more recent low-cost waste treatment processes were compared for economic merits in treating various pulp and paper mill effluents. For mills with daily productions of 50 to 500 tons, an oxidation pond was found to be the cheapest alternative in treating combined paper machine white water plus bleach plant effluent, whereas anaerobic-aerobic lagoons seemed most economical for treating pulping wastes. Other than economic factors to be considered in selecting effluent treatment installations include availability, reliability, ease of operation, and maintenance of appropriate equipment. (Wise-W74-03548

NEW COMPOSITE EFFLUENT-PURIFICATION EQUIPMENT (NOVYI KOMPLEKS OCHIST-NYKH SOORUZHENII), A. Yu. Skaisgiris, and I. M. Skorupskas.

Bumazhnaya Promyshlennost' No 3, p 21-22, March 1973. 1 fig.

Descriptors: \*Treatment facilities, \*Pulp wastes, \*Bleaching wastes, \*Waste water treatment, \*Water conservation, Pulp and paper industry, Europe, Recycling, Water circulation, Industrial wastes, Sedimentation, Suspended solids, Filters, Clays, Flocculation, Pipes, Equipment.

Identifiers: White water, Black liquor, Savealls, \*Lithuania (Neman River). Keramzit (Clay

Since 1970, the Yu. Ianonis integrated pulp and paper mill in Kaunas, Lithuania, producing print-ing papers from bleached pulp, has operated facilities for treatment of both white (clean) and black (polluted) waste waters, collected separately. Of the mill's ten conical savealls, six process 'clean' waters (from broke-handling thickeners and paper machine white water), the other four handle 'polluted' wastes (from wet presses, felt conditioners, spills, and machinery wash waters). While all savealls operate continuously, recovered fibers and fillers are removed periodically. Solids recovered from the 'clean' savealls are recycled to hydrapulpers for reuse in paper furnish. Sediment from the 'polluted' savealls is shipped to a nearby ceramic factory and reused in the manufacture of 'keramzit' clay-type filler. Clarified 'clean' waste water (20-30 mg of suspended solids/liter) is recycled as process water for freshwater conservation. Clarified 'polluted' waste water is discharged into the Neman River. All savealls have inlet pipes for metered dosage of flocculants, such as aluminum sulfate and polyacrylamide, but the installation provides 95-97% purification even without additives. (Stapinski-IPC) W74-03554

POWER INPUT FOR THE SURFACE AERATOR IN WASTE WATER TREATMENT PLANTS
(PRIKON POVRCHOVEHO AERACNIHO
MICHADLA PRO CISTENI ODPADNICH VOD),
Vyzkumy Ustav Chemickych Zarizeni, Brno (Czechoslovakia).

Chemicky Prumysl, Vol 23, No 2, p 63-69, February 1973. 9 fig, 2 tab, 20 ref.

Descriptors: \*Aeration, \*Treatment facilities, \*Waste water treatment, Energy, \*Energy equa-tion, \*Power operation and maintenance, Electric power, Reynolds number, Froude number, Flow, Mixing, Turbulence, Equipment, Equations, Mathematics, Mathematical models, Mathematic cal studies, Specific gravity, Submergence, Density, Viscosity, Shape, Contours. Identifiers: \*Aerators, Euler number, Mixing

The effects of effluent viscosity, aerator depth, and tank shape on aerator power consumption were studied under optimized aeration conditions. Results of the study were used to develop equa-tions expressing the relationships between Euler, Froude, and Reynolds numbers. It is concluded that aerator power demand depends mainly on the depth of immersion and the specific gravity (density) of the effluent being treated. A decrease in density of the air-effluent mixture was reflected in increased Froude numbers. No significant differenc in power consumption was found between rectangular mixing tanks and circular tanks with baffles. The equations developed can be applied to the design of waste water aerators. (Trubacek-IPC) W74-03555

PH AND THE EFFECTIVENESS OF EFFLUENT PURIFICATION (PH I EFFEKTIVNOST' OCHISTKI STOCHNYKH VOD), M. B. Berov, L. I. Shmidt, and V. M. Shapchenko.

Bumazhnaya Promyshlennost', No 2, p 6-7, February 1973. 3 fig.

# **Group 5D—Waste Treatment Processes**

Descriptors: \*Waste water treatment, \*Coagula-tion, \*Aluminum, \*Color, \*Hydrogen ion concen-tration, Effluents, \*Pulp wastes, Pulp and paper industry, Flocculation.

Coagulants, Aluminum Identifiers: Decoloring, Kraft mills, Precipitation (Chemical), Chemical consumption, Aluminum hydroxide, Aluminum compounds.

Biologically treated kraft mill effluents are usually purified from lignin and suspended solids by coagulation with aluminum hydroxide sol. The Al concentration in the purified effluent is decisive for its potential reuse, e.g., in filtration plants or aeration ponds, because too high concentrations result in flocculation and precipitation of Al hydroxide upon pH adjustment, as well as in chemical losses. The coagulation-stage pH was studied as a function of resulting effluent color and Al content. In the absence of Al, reduction of effluent color to 100 degrees (on the Co-Pt scale) occurred only below pH 3.3; the same effect oc-curred at pH 3.8 when small amounts of Al sulfate were present. With 20-30 mg/liter of the coagulant (expressed as Al oxide), the color dropped below 100 degrees and was independent of pH below pH 6; still higher amounts of Al sulfate caused no further color reductions. The minimum Al concentration was found between pH 5.9 and 6.3. Taken together, these data indicate that the best pH for minimization of both effluent color and residual Al content should be 5.5-5.8. (Stapinski-IPC)

CLEANUP OF POLLUTED RHINE RIVER WILL COST WESTERN EUROPE BILLIONS. For primary bibliographic entry see Field 05G.

BIG PLANT WILL TREAT WASTE WITH PURE OXYGEN.

Engineering News-Record, Vol 191, No 8, p 28-31, August 23, 1973. 2 fig, 1 photo.

Descriptors: \*Oxygenation, \*Sewage treatment, \*Aerobic treatment, \*Waste water treatment, \*New Jersey, Oxygen, Biochemical oxygen demand, Dissolved oxygen, \*Aeration.
Identifiers: Pure oxygen aeration, Compression,

Biochemical oxygen demand removal, Sayreville (New Jersey).

The nation's first major sewage treatment plant to use a pure oxygen aeration process is slated for construction at Sayreville, New Jersey. Operations are expected to begin by December, 1976. The project is designed for an average flow of 120 mgd and 90% removal of BOD and suspended solids. Average detention time for effluent in the aeration tanks will be 3.6 hours. Comparable BOD removal in an activated sludge process would require about 6 hours. Shorter detention time enables the plant to be smaller. Use of pure oxygen, as opposed to air, which is free, will save capital and operating costs of compression equipment. The heart of the secondary treatment process will be four oxygenation tanks through which sewage will pass. Flow through the plant might be expandable to 160 mgd. The plant is flexible so that some sewage can be sent through only two of the tanks, while other sewage can be treated in the other tanks, allowing for controlled experiments with detention time or other variables. A 400-ton cryogenic oxygen manufacturing plant will supply the new facility. Sludge from the plant will ulti-mately be dumped in the Atlantic Ocean. (Stein -North Carolina) W74-03638

INSTRUMENTATION FOR WATER POLLU-TION MONITORING, Honeywell, Inc., Fort Washington, Pa. C. P. Blakely, and T. K. Thomas.

Environmental Science and Technology, Vol 7, No 11, p 1006-1010, November, 1973. 2 fig. 4

Descriptors: \*Instrumentation, \*Water measurement, \*Monitoring, \*Water pollution control, Gages, Automation, Control systems, Data collections, Sampling, Dissolved oxygen, Water quality control, Waste water treatment. Identifiers: \*Magnetic flowmeter.

Continuous analysis and composite sampling instruments are an integral part of any wastewater treatment scheme. Sampling of water proportional to flow or at few regular intervals may mask peaks and valleys of water quality, since concentrations of wastes in water vary within short times. Problems of deciding whether to buy, rent, or lease monitoring equipment are discussed. When only one or two parameters need to be monitored, it is generally economical to measure them directly, using a submersible sensor nest or individually submersible sensors. Once the water quality problem has been defined, treatment can begin. Activated sludge treatments for organic wastes are discussed. The magnetic flowmeter is probably the most commonly used device for measuring flow and dissolved oxygen, the most important control parameters. These devices are based on Faraday's law of electromagnetic induction.

Operative principles of the devices are further explained, as well as technical applications of dissolved oxygen measurements. Treatment of inorganic wastes involves oxidation, reduction, precipitation, or neutralization; treatment processes are explored. Instrumentation needed for the processes is discussed. The current trend in instrumentation technology is toward electronic monitoring and control from a central point. (Stein - North Carolina) W74-03640

IODINE TREATED ACTIVATED CARBON AND PROCESS OF TREATING CONTAMINATED WATER THEREWITH.

Culligan, Inc., Northbrook, Ill. (Assignee). E. G. Kreusch, and F. F. Husseini. U.S. Patent No. 3,772,189, 3 p, 4 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 663, November 13, 1973.

Descriptors: \*Patents, \*Activated carbon, \*Iodine, \*Waste water treatment, Pollution abate-Descriptors: ment, Water quality control, Water pollution con-trol, \*Bacteria.

Identifiers: Bacteriostatic carbon bed.

An activated carbon bed is treated with an iodine solution and the iodine is reversibly absorbed by the carbon. The carbon bed is rinsed until the ef-fluent is free of iodine. The rinsed carbon bed is mixed by backwashing to an approximately 50 percent bed expansion to obtain a homogeneous iodine content within the bed. Bacterially contaminated water is passed through the rinsed and mixed carbon bed containing a homogeneous distribution of iodine therein with the carbon releasing the previously absorbed elemental iodine to treat the water and thereby reduce the bacterial content. The iodine solution which is passed through the carbon bed has a normality of between about 0.1 N and about 0.2 N and is passed through the carbon at a rate of between about 0.25 and 1.25 gallons per minute per cubic foot of carbon. (Sinha-OEIS) W74-03651

METHOD FOR PURIFYING WATER,

Otto Durr K.G., Stuttgart (West Germany) (Assignee). R. Eisenmann.

U.S. Patent No. 3,772,190, 3 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 663, November 13, 1973. Descriptors: \*Patents, \*Paints, \*Electrophoresis, \*Foam separation, \*Coagulation, \*Waste water treatment, Pollution abatement, Water pollution control, Water quality control, Separation techniques. Identifiers: Enamel.

A method and an apparatus are described for purifying water and more particularly for separating particles of paint, enamel or the like from the wash water of electrophoresis painting apparatus. The polluted water is mixed with air so as to produce a foam, for example, a paint foam, and the foamy mixture is subjected to a separating process in which the paint or other undesired substance is removed from the water. An essential feature consists in subjecting the polluted watery mixture to a first separating stage for partly purifying the water and in then subjecting the outcome of this first stage to a second stage in which the water is again thoroughly mixed with air and frequently recirculated and again separated from the impurities. In the first stage of the process the mixture is mixed and circulated while a coagulant is added, the second stage of the process may be carried out without adding any coagulant. The foam which is produced in the separating process of the second operating stage is supplied to the foam which is produced in the first operating stage by overflowing from one container to another and thereafter the entire foam is removed from the liquid. Even though the new apparatus requires two operating stages, this apparatus may be made of a relatively simple and inexpensive structure. The separating container of the second stage is preferably located at a higher level than that of the first stage and connected by an overflow with the latter. (Sinha-W74-03652

SYSTEM FOR PURIFICATION OF POLLUTED

WATER, Max-Planck-Gesellschaft zur Forderung der Wissenschaften e.V. Goettingen (West Germany). (Assignee). K. Seidel.

U.S. Patent No. 3,770,623, 6 p, 6 fig, 2 tab, 5 ref; Official Gazette of the United States Patent Office, Vol 916, No 1, p 250, November 6, 1973.

Descriptors: \*Patents, \*Waste water treatment, Pollution abatement, \*Filtration, Aquatic plants, Pathogens, \*Sewage treatment, Nitrogen Nutrients, E. coli, \*Enteric bacteria, \*Salmonella. Nitrogen, Identifiers: Scripus lacustris, Phragmites commu-

Polluted water is fed into a settling tank. Clear water, containing only colloidal matter, pathogenic organisms, and dissolved materials, is passed into one of two filtration beds each consisting of a bottom layer of a coarse porous material and a top layer of a fine porous material having rooted or growing plants having nodes. A suitable plant is Phragmites communis. Water leaving the filtration beds contains only dissolved material and pathogenic organisms. This water is then passed through an elimination bed containing a layer of porous material such as sand in which a suitable plant such as Scirpus lacustris is rooted. The pollutants serve as nutrients for the plants. Some of the pollutants are eliminated by sustances exuded by these plants. It is pointed out that plants with bacterial nodules kill pathogens such as Escherichia coli, Enterococci, salmonellae etc. The root nodules are nitrogen collectors and contain the ability to produce substances related to streptomycin. This substance is said to kill certain pathogens found in the water. (Sinha-OEIS) W74-03655

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

# Waste Treatment Processes—Group 5D

SEWAGE TREATMENT APPARATUS AND METHOD.

U.S. Patent No. 3,772,188, 8 p, 14 fig, 12 fig; Official Gazette of the United States Patent Office, Vol 916, No 2, p 662, November 13, 1973.

Descriptors: \*Patents, \*Sewage treatment, \*Oxidation, \*Sterilization, \*Waste water treatment, Polymers, Equipment, Pollution abatement, Phosphates, Color, Taste, Phenols, Odor, Hydrogen ion concentration.
Identifiers: \*Cyanide.

sewage treatment apparatus is provided to achieve biological and chemical oxidation, sterilization, and reduction of undesirable color, taste, odor, phenol, cyanide and phosphate. It comprises an enclosed pressurized vessel which receives the sewage at its lower portion. High purity oxygen is admitted in the upper portion which also contains a comminutor device. In the upper portion particle size is reduced thus increasing the surface area available to quickly absorb the ygen under pressure to provide rapid oxydation and ozone sterilization. Inlets are also provided to supply polymers for stimulating reduction of the non-oxidizable substances. The pH is controlled during various states of the procedure. (Sinha-OFIS W74-03656

### SEWAGE TREATMENT PROCESS,

D. F. Othmer.

U.S. Patent No. 3,772,187, 8 p, 1 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 662, November 13, 1973.

Descriptors: \*Patents, Water pollution control, \*Waste water treatment, \*Sewage treatment, \*Biochemical Oxygen Demand, \*Dissolved oxygen, Oxidation, Atmospheric pressure, Water quality control, Sedimentation, Pollution abatement, \*Recycling.

Domestic sewage and other polluted waters may be treated under a pressure of 1/2 to 5 atmospheres guage or more with dissolved oxygen, or air, to supply the BOD. The oxygen-containing gas is drawn into the suction of a feed and recycle pump which agitates the liquid-gas mixture, and inwhich agnates the inquio-gas mixture, and in-creases gas solubilization as it is being com-pressed. Simultaneously, any solids which are present are comminuted in being pumped to the pressure oxidation tank. The higher than atmospherhic pressure increases oxygen solubility, concentration, and hence chemical or biochemical reactivity. Thus, a much smaller residence time and vessel is required, the polluted water is withdrawn and depressurized to atmospheric pressure at which pressure some of the dissolved oxygen and other gases are released due to lower solubility, and vented. Most of the liquid after depressurization is recycled to the influent stream for repressurization and additional oxygen dissolu-tion. The recycle may amount to 2 to 50 times, and some sludge obtained may also be recycled. A water turbine may recover some of the mechanical energy used by the pump. The process may be by itself or as an adjunct to other processes for treating polluted waters, and also for the oxidation of sludge. (Sinha-OEIS) W74-03657

COMPOST FOR REMOVING OIL FILMS FROM WATER,
International Minerals and Chemical Corp.,

Libertyville, Ill. (Assignee).

J. P. Harnett. U.S. Patent No. 3,771,653, 4 p, 4 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 535, November 13, 1973.

Descriptors: \*Patents, Oil spills, \*Oil pollution, \*Pollution abatement, Water quality control,

Water pollution control, Separation techniques, Absorption, Films. Oleophilic matter, Hydrophobic matter, \*Compost, Aerobiodigestion.

An oil film is removed from the surface of water by contacting the same with a compost prepared by the aerobic digestion of organic waste material. The compost with the absorbed oil floats on the water and can be easily collected to recover the oil. The oil is then separated from the compost, which may then again be used for recovering more oil. Alternatively, the compost is weighted to such a degree that it will sink to the bottom of the water after absorbing oil from the layer of oil on top of the water. The compost materials employed are oleophilic and hydrophobic, so that they will preferentially absorb oil from water. The oils which are absorbed in this process include all oils which are immiscible in water, whether they are of mineral, vegetable or animal origin. Mineral oils that are lighter than water, such as crude oil, gasoline, fuel oil and lubricating oils, are the most common oily contaminants of water and, therethe most likely to be recovered. (Sinha-OFIS) W74-03658

# WATER CIRCULATION SYSTEM FOR FRESH WATER FISH HUSBANDRY.

Marine Protein Corp., New York. (Assignee). W. A. Doherty.

W. A. Doherty.
U.S. Patent No. 3,771,492, 4 p, 2 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 494, November 13, 1973.

Descriptors: Freshwater fish. \*Waste water treatment, Water quality control, \*Ammonia, Water pollution control, \*Filtration, Pollution abatement, Oxidation lagoons, Water reuse, \*Fish farming, Recharge ponds.

Identifiers: Fish husbandry, \*Metabolites.

A system is described in which a local, natural water table is employed as the source of water used in the fish husbandry operation. A plurality of wells or springs are employed to tap the water and to bring it to the surface for access in the tanks and/or raceways in which the fish are being raised. The water which is passed through a series of tanks and/or raceways, is treated by having at least oxygen and feed added. As the water picks up metabolites, including ammonia, thrown off by the fish it becomes sufficiently polluted so that it can no longer be used for the economic raising of fish. This water is then filtered to remove the solid particles or offal component of the metabolites. The filtered water is then put into a large settling pond which is lined with oyster shells. As the water sits in the settling pond, a large proportion of the ammonia escapes into the atmosphere. Additionally sunlight causes breakdown of some of the ammonium compounds releasing ammonia which also escapes. Both effects reduce the amount of dissolved ammonium products to an acceptably low level. The water then gradually passes through the layer of oyster shells and into the earth around and below the settling pond. As the water passes through the earth it becomes further purified and returns to the water table. At the water table, the water's temperature returns to that of the water table, which is the water temperature for which the site was selected in the first place and is a temperature at which the particular species of fish involved will have close to optimum growth. (Sinha-OEIS) W74-03659

# METHOD OF TREATING OIL-CONTAINING

CONTAMINATED DRAINAGE, Nippon Oil Co. Ltd., Tokyo. (Assignee). J. Yamamoto, K. Minakawa, H. Nishikado, and S.

U.S. Patent No. 3,770,628, 5 p, 2 fig, 6 tab, 2 ref; Official Gazette of the United States Patent Office, Vol 916, No 1, p251, November 6, 1973. Descriptors: \*Patents, \*Oil pollution, Drainage, \*Filtration, \*Activated carbon, Pollution abatement, \*Waste water treatment. Identifiers: Way

The treatment of oil-containing contaminated drainage is carried out by use of a combination of processes selected from (a) a wax-filled bed-an active carbon bed process, (b) a sandfilter-a waxfilled bed process, and (c) a sandfilter-a wax-filled bed-an active carbon bed process. Nine example illustrate the use of the various combination of processes. The intimate contact of oil-containing drainage with wax in a vessel filled with wax results in highly effective adsorption of the oil content on the wax even if oil particles are very fine. A high coalescing capability enables effective separation and removal of the oil content by settlement. In the removal of most of the oil content with wax and of the remaining substances with ac-tive carbon, the amount of phenol at adsorption equilibrium is increased from one and a half tir to twice as much as the initial when the ratio of oil to active carbon is 20-30 ppm. Placement of a sandfilter to remove substances before they enter the waxed area preserves the adsorbing capacity of the wax. (Sinha-OEIS) W74-03660

FILTRATION SYSTEM FOR LIQUIDS, Coleco Industries, Inc., Hartford, Conn. (as-

For primary bibliographic entry see Field 05F.

# METHOD OF SEPARATING METALS FROM

WASTE WATER, Mitsui Mining and Smelting Co. Ltd., Tokyo (Japan). (assignee). M. Ichiki, and M. Ishii.

U.S. Patent No. 3,766,035, 3 p, 6 ref; Official Gazette of the United States Patent Office, Vol 915, No 3, p 1021, October 16, 1973.

Descriptors: \*Patents, \*Waste water treatment, Metals, Cadmium, Zinc, Lead, Copper, Nickel, Iron, Chromium, Manganese, Mercury, Aluminum, Pollution abatement, \*Separation techniques, Ions, \*Surfactants, \*Emulsifiers.

The electrolytic purification of waste water containing metal ions is accomplished by adding an organic solvent and a nonionic surface active agent capable of emulsifying the solvent to the waste water. A portion of 1 to 50 grams of organic solvent per one cubic meter of waste water The organic solvent may be selected from the group consisting of toluene, xylene, mineral spirit and solvent naphtha. The nonionic surface active agent may be selected from the group polyoxyethylene alkyl ether, polyoxyethylene phenol ether, polyoxyethylene sorbitan fatty acid ester, polyoxyethylene acylester, sorbitan fatty acid ester, oxyethylene-oxypropylene block polymer, and fatty acid monoglyceride. (Sinha - OEIS) W74-03664

# PHOSPHOROUS REMOVAL FROM WASTE-

Union Carbide Corp., New York. (assignee). M. J. Stankewich, Jr.

U.S. Patent No 3,764,524, 15 p, 2 fig, 2 tab, 7 ref; Official Gazette of the United States Patent Office, Vol 915, No 2, p 638, October 9, 1973.

Descriptors: \*Patents, \*Phosphorous, \*Carbon, \*Aeration, Activated sludge, Biochemical oxygen demand, Nitrogen, \*Waste water treatment, Chemical precipitation, \*Oxidation. Identifiers: Ferric chloride. Aluminum sulfate.

A method is described for removing both carbon food and phosphorous pollutant by biochemical oxidation and chemical precipitation using oxygen gas in the presence of activated sludge. Most of

# Group 5D-Waste Treatment Processes

the carbon food and pollutant are removed in a first covered zone with the addition of phosphorous-precipitating compound and under high food-to-biomass ratio. The effluent is further purified in a second covered zone under low foodto-biomass ratio. (Sinha - OEIS)

HYPERBOLIC CROSS FLOW TOWER WITH BASINS AND COOLING FILL IN-TEGRATED INTO SHELL,

Marley Co., Kansas City, Mo. (assignee). H. E. Fordyce.

U.S. Patent No 3,764,121, 6 p, 7 fig, 12 ref; Official Gazette of the United States Patent Office, Vol915, No 2, p 547, October 9, 1973.

Descriptors: \*Waste water treatment, \*Patents, \*Cooling towers, Water cooling, \*Thermal pollution, Heated water, Pollution abatement, Equipment, Water pollution control.

A fireproof, hyperbolic, natural draft, crossflow water cooling tower is described. It has a two story fill assembly structure between respective concrete hot water distribution and cold water basins within the tower shell and integral with the air inlets of the shell. Stainless steel fill and eliminator supports suspended from the distribution and basin units carry transversely threequarter wave asbestos cement board fill members and transversely full wave eliminator bars respectively cut from corrugated sheets. The fill members are placed on edge with the longitudinal length parallel to the air flow through each fill assembly structure while the eliminator bars lie in flat, generally horizontal disposition with the longitudinal axes slightly tilted for drainage of the bars and located perpendicular to the path of travel of air through respective fill assembly structures. (Sinha - OEIS) W74-03668

METHOD OF DIGESTING AND FURTHER PROCESSING FRESH SEWAGE SLUDGE OR SAPROPEL,

W. Thorn.

U.S. Patent No 3,772,191, 4 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 916, No 2, p 663, November 13, 1973.

Descriptors: \*Waste water treatment, \*Patents, \*Sewage treatment, \*Sludges, \*Filtration, Calcium hydroxide, Pollution abatement, Water pollution control, Water quality control, Hydrogen ion concentration.

Identifiers: \*Sapropel, Acidification, Hydrochloric acid, Calcium oxide.

A process of digesting and further processing fresh sludge and/or sapropel is characterized by acidifying the pumpable fresh sludge and/or sapropel of predominantly biological original in a reaction vessel with mineral acid until the pH value has fallen below 5 and the mixture begins to separate. There follows a fine adjustment of the pH value with fuming hydrochloric acid to the isoelectric ranges of the most high-molecular sludge substances of biological original thereby completely separating the mixture. This is followed by removing the hydrophobic substances which have accumulated in the upper part of the vessel. The precipitated sludge is separated from the supernatant liquid. The sludge is then reacted with calcium hydroxide or calcium oxide and then dehydrated in filter presses. (Sinha - OEIS) W74-03671

WASTEWATER LAND TREATMENT SITE REGULATION ACT.

For primary bibliographic entry see Field 06E. W74-03725

SOME TECHNICAL AND ECONOMIC CON-CERNS RELATING TO SHIPBOARD POLLU-TION ABATEMENT.

Naval Postgraduate School, Monterey, Calif.

Available from the National Technical Information Service as AD-755 540, \$3.00 in paper copy, \$1.45 in microfiche. Technical Report NPS-61RW72121A, December 1972. 57 p, 107 ref.

Descriptors: \*Pollution abatement, \*Ships, Water pollution source, Sanitary engineering, Estimated costs, \*Waste water treatment, Waste disposal.

Three shipboard pollution abatement questions are examined. First, treatment systems are evaluated with respect to cost, safety, reliability and size, subject to minimum EPA standards. Limited flush, incineration and biological treatment are feasible, with wet air oxidation considered a researchable method to obtain a future integrated waste disposal system. Limited space and adverse saltwater effects on microorganisms make biological treatment less desirable. The biological effects of Naval oil and waste dumping is also examined. Ocean sewage dumping is not an effective bactericide, although diffusion, sunlight, osmotic shock and predation are beneficial; dumping does not presently seriously affect the ocean's homeostasis. Small oil concentrations have a measurable effect on the diversity of surface dwelling species. Oil-consuming bacteria fare poorly in the open sea. Technological problems are briefly discussed and a short literature review is given. The economic savings of sending waste ashore for treatment is the third question examined. Attention is given to possible adverse affects of seawater on municipal sewerage systems and inhibition of biological activity. Public reaction to this method appears cool, although there are no technical or economic reasons to preclude its feasibility. (Schroeder-Wisconsin) W74-03743

# 5E. Ultimate Disposal of Wastes

UNDERGROUND WASTE MANAGEMENT AND ARTIFICIAL RECHARGE, VOLUMES 1 AND 2.
American Association of Petroleum Geologists. Inc., Tulsa, Okla.

Preprints of papers presented at the 2nd International Symposium held at New Orleans, Sept 26-30, 1973: American Association of Petroleum Geologists, Inc., 1973. 931 p.

Descriptors: \*Artificial recharge, \*Underground waste disposal, \*Waste disposal wells, \*Conferences, Industrial wastes, Sewage disposal, Brines, Radioactive waste disposal.

In recent years, deep-well disposal has been the subject of much discussion and criticism. Its use is relatively limited considering the wide divergence in chemical composition of wastes. However, if installations are properly conceived, constructed, and operated, and are installed in a suitable geologic setting, they can fulfill a need without creating other problems such as can occur with use of waste-retention basins, incineration, or possibly even sludge disposal. At the least, the deep-well method removes the waste from the biosphere. Because the capacity of potential receiving formations is finite, unrestricted deep-well disposal should not be allowed. Control measures include the awarding of permits and the delineation of factors such as acceptable injection rates and pressures, types of materials used for construction, and tests and monitoring facilities to insure the utility and safety of the installation. (See W74-03223 thru W74-03250) (Knapp-USGS) W74-03222

DESIGN AND OPERATION OF LAND TREAT-MENT SYSTEMS FOR MINIMUM CON-TAMINATION OF GROUNDWATER.

Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 05D. W74-03223

SALINE AQUIFERS--FUTURE RESERVOIRS FOR FRESH WATER, STORAGE Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
O. K. Kimbler, R. G. Kazmann, and W. R.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 192-206. 1973. 4 fig, 4 tab, 3

Descriptors: \*Water storage, \*Artificial recharge, Aquifers, Hydrogeology, Saline water-freshwater interfaces, Saline water, Aquifer characteristics. Identifiers: \*Saline aquifers.

Some saline aquifers may be useful for freshwater storage. Several model aquifers and approximate mathematical models were studied. The annual cycle of injection, storage, and withdrawal of the freshwater is feasible under the idealized assumptions normally found in groundwater hydrology—a horizontal, isotropic, homogeneous aquifer of uniform porosity, transmissivity, and storativity. Laboratory experiments on a single-well system built into a mini-aquifer constructed of epoxy-consolidated, uniform blasting sand show that the efficiency of the process, per cycle, increases as the number of cycles increases. Storage of freshwater in an aquifer that contains brine is feasible, if a sufficient number of cycles is considered. In a 9unit well field, although the recovery percentage of the end of the first cycle is smaller than that of a single well operating by itself, the recovery rate of a multi-well configuration increases as the number of cycles increases. (See also W74-03222) (Knapp-W74-03224

ARTIFICIAL RECHARGE IN UNITED KING-DOM WITH SPECIAL REFERENCE TO LON-DON BASIN.

Water Resources Board, Reading (England). For primary bibliographic entry see Field 04B. W74-03225

UNDERGROUND WASTE DISPOSAL AND AR-TIFICIAL RECHARGE IN JAPAN,

Tokyo Univ. of Education (Japan). Faculty of Science.

S. Yamamoto.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 60-71. 1973. 4 fig, 5 tab, 4

Descriptors: \*Underground waste disposal, \*Waste disposal wells, \*Artificial recharge, Injection wells, Alluvium, Industrial wastes, Acids, Land subsidence. Identifiers: \*Japan.

Artificial recharge, which is needed to control problems of land subsidence and saltwater intrusion, is in the experimental stage in Japan. Three sites in Kanazawa, Tsuruga, and Yamagata have successful artificial-recharge wells. These sites are all on similar alluvial-fan deposits, but have quite different injection rates. This difference is at-tributed to differences in well structure and completion procedure, in particular, performation. Underground waste disposal is practiced with many complex and often dangerous fluid wastes in Japan, but the operations are secret. Two successful injection operations involve disposal of acid waste from a sulfur mine and thermal water from a geothermal electric generating plant. (See also W74-03222) (Knapp-USGS) W74-03226

SUBSURFACE DISPOSAL OF LIQUID INDUSTRIAL WASTES IN ALABAMA-A CURRENT STATUS REPORT,
Geological Survey, University, Ala.
K. P. Hanby, R. E. Kidd, and P. E. LaMoreaux.
In: Underground Waste Management and Artificial Recharge, Vol 1, p 72-90. 1973. 9 fig, 15 ref.

Descriptors: "Waste disposal wells, "Alabama, "Underground waste disposal, Hydrogeology, Investigations, "Industrial wastes.

Five subsurface disposal wells have been drilled and completed in Alabama. At present in Alabama, subsurface disposal is permissible for some types of wastes if the well is properly designed and completed in an appropriate geologic environment, if conventional methods of waste treatment have been evaluated and proved to be inadequate, and if an adequate monitoring system has been installed. The geology, drilling, comple-tion, and testing techniques involved in these wells are presented as a basis for discussion of decisionmaking for approval or rejection of the proposed deep-well disposal projects by a regulatory agen-cy. (See also W74-03222) (Knapp-USGS) W74-03227

EFFECTS OF WASTE PERCOLATION OF GROUNDWATER IN ALLUVIUM NEAR BARSTOW, CALIFORNIA, Geological Survey, Garden Grove, Calif. J. L. Hughes, and S. G. Robson.

In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 91-129, 1973. 12 fig, 1 tab,

Identifiers: \*Barstow (Calif).

Descriptors: \*Waste water disposal, \*Alluvium, Path of pollutants, Irrigation water, Percolation, Infiltration. Groundwater movement. Malenclaves, Water pollution sources, \*California.

Part of the alluvial aquifer along the Mojave River near Barstow, California, has been subjected to pollution from percolation of wastes and sewage from industrial and municipal sources for about 60 years. The pollution has forced the abandonment of several domestic wells because of taste, odor, and foaming, and it threatens the well field serving the U.S. Marine Corps Supply Center. An old plume of degraded water produced by percolation from sewage and waste-disposal facilities near Barstow is moving near the base of the alluvial aquifer. Since 1910 this degraded plume has moved downgradient about 4 mi. A more recent overlying plume of degraded water is located near the downstream edge of the deeper plume. This overlying plume is produced by percolation from sewage-treatment facilities installed in 1968. The gradual increase in concentration of dissolved solids in the U.S. Marine Corps wells results in part from the use of treated sewage effluent on a local golf course. A digital water-quality model of the aquifer aided in evaluating the effects of several alternative groundwater management practices. Model results indicate that by 1991 present sewage-percolation practices would result in dissolved-solids concentrations exceeding 900 mg/liter in the Marine Corps well field. (See also W74-03222) (Knapp-USGS) W74-03228

ROLE OF BOREHOLE GEOPHYSICS IN UN-

DERGROUND WASTE STORAGE AND ARTIFI-CIAL RECHARGE, Geological Survey, Denver, Colo. W. S. Keys, and R. F. Brown. In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 147-191, 1973. 17 fig, 49 ref.

Descriptors: \*Borehole geophysics, \*Artificial recharge, \*Waste disposal wells, \*Injection wells, Electrical well logging, Radioactive well logging, Borehole cameras, Subsurface investigations, Hydrogeology.

Borehole geophysics is being used by the U. S. Geological Survey to study geohydrologic parameters related to recharging the Ogallala Formation on the High Plains of Texas. The optimum utilization of underground space for the emplacement and storage of waste and surface water can be achieved through an understanding of the geohydrologic environment. The emplacement of liquid waste and the artificial recharge of aquifers generally requires the drilling of exploration, injection, and monitoring wells. Some geophysical logs are run on almost all wells drilled for deep disposal. Logs provide data on the location, thickness, and lateral continuity of storage zones and confining beds, amount and distribution of nitude of permeability. Intergranular and fracture porosity can be discriminated by cross-plotting acoustic-velocity and neutron or gamma-gamma logs. The distribution and orientation of preinjection fractures can be determined by acoustic tion fractures can be determined by acoustic televiewer logs. Logs provide data on the chemical quality of the native fluids and the mineralogy of the aquifer, which are necessary to predict chemi-cal reactions with injected fluids. The temperature and conductivity of the interstitial fluids may be measured directly and their specific gravity and viscosity may be calculated from log data. After vascosity may be calculated from log data. After waste injection or artificial recharge has started, logs provide in-situ measurements of changes in the system. (See also W74-03222) (Knapp-USGS)

FEASIBILITY STUDY OF A SEISMIC REFLEC-TION MONITORING SYSTEM FOR UN-DERGROUND WASTE-MATERIAL INJECTION

Fetty-Ray Geophysical Group, San Antonio, Tex. For primary bibliographic entry see Field 05B. W74-03230

HYDRAULIC FRACTURING AS A TOOL FOR

DISPOSAL OF WASTES IN SHALE, Geological Survey, Washington, D.C. R. J. Sun.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 219-270, 1973. 28 fig, 1 tab, 38 ref, append.

Descriptors: \*Underground waste disposal, \*Injection wells, "Waste disposal wells, "Grouting, "Shales, Borehole geophysics, Electrical well logging, Radioactive well logging.

The injection of wastes mixed with cement grout into thick shale formations is a promising method for effective immobilization of toxic wastes in a nearly impermeable medium. Hydraulic fracturing provides openings in the shale during the grout in jection. To retain certain types of wastes better, ion-exchange and adsorption agents can be added to the grout when it is mixed. After solidification of the grout, the injected wastes will become an in-tegral part of the shale and remain there as long as the shale is not subject to erosion. In bedded shale there is a great difference in tensile strength between the direction normal to and the direction parallel with bedding planes. This difference in tensile strength may favor the formation of hydraulically induced fractures along beddding planes within a zone of limited vertical extent. Before construction of a waste-disposal facility it is necessary to test the site by injecting water or non-toxic grout tagged with radioactive tracer to judge whether a zone of fractures can be induced paral-lel with the shale bedding planes. Injection pressure, pressure decay, movement of the ground surface, and gamma-ray logs of observation wells may be used to interpret the orientation of the may be used to interpret the orientation of the hydraulically induced fractures during the site-selection tests. A case history of hydraulic fractur-ing at West Valley, New York, illustrates the method of evaluating a site. Waste disposal through an injection well should be conducted in multiple-layer injection stages. The first injection starts at the greatest depth, then the injection zone is plugged off by cement, and the second injection is started at a suitable distance above the first one. (See also W74-03222) (Knapp-USGS)

SHORT-TERM EFFECT OF INJECTION OF TERTIARY-TREATED SEWAGE ON IRON CONCENTRATION OF WATER IN MAGOTHY AQUIFER, BAY PARK, NEW YORK, Geological Survey, Mineola, N.Y. For primary bibliographic entry see Field 05C. W74-03232

RADIOACTIVE- AND CHEMICAL-WASTE TRANSPORT IN GROUNDWATER AT NA-TIONAL REACTOR TESTING STATION, IDAHO: 20-YEAR CASE HISTORY AND DIGITAL MODEL, Geological Survey, Idaho Falls, Idaho. For primary bibliographic entry see Field 05B.

W74-03233

MODIFICATION OF ARTIFICIALLY RECHARGED WATER IN SWITZERLAND, For primary bibliographic entry see Field 05B. W74-03234

HYDRODYNAMICS OF MOUNT SIMON SAND. STONE, OHIO AND ADJOINING AREAS, Geological Survey, Columbus, Ohio. For primary bibliographic entry see Field 05B. W74-03235

DEDUCTION OF FLOW PATTERNS IN VARIA-BLE-DENSITY AQUIFERS FROM PRESSURE AND WATER-LEVEL OBSERVATIONS, Illinois State Geological Survey, Urbana. For primary bibliographic entry see Field 04B. W74-03236

UNDERGROUND STORAGE AND RETRIEVAL OF FRESH WATER FROM A BRACKISH--WATER AQUIFER, Geological Survey, Norfolk, Va. For primary bibliographic entry see Field 04B.

W74-03237

RETENTION OF DISSOLVED CONSTITUENTS OF WASTE BY GEOLOGIC MEMBRANES, Geological Survey, Menlo Park, Calif. For primary bibliographic entry see Field 05B. W74-03238

HYDROGEOLOGIC STUDIES AT A SUBSUR-FACE RADIOACTIVE-WASTE-MANAGEMENT SITE IN WEST-CENTRAL CANADA, Waterloo Univ. (Ontario). Dept.

Sciences J. A. Cherry, G. E. Grisak, and W. E. Clister.

In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 436-467, 1973. 11 fig, 3 tab,

Descriptors: \*Underground waste disposal, \*Canada, \*Groundwater \*Radioactive wastes, movement, \*Hydrogeology, \*Path of pollutants,

One of Canada's two main subsurface radioactivewaste-management sites is located at the Whiteshell Nuclear Research Establishment in southeastern Manitoba. The area receives low-, medium-, and high-level solid wastes and small amounts of liquid waste. The wastes are buried at depths as great as 15 ft below ground surface and are below the water table, which is normally within a few feet of the ground surface. No significant groundwater contamination has occurred since use began in 1964. The waste-management

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operations are carried out in deposits of Pleistocene clay and clay-loam till. The deposits have significant secondary hydraulic conductivity resulting from numerous fractures. Because of high hydraulic head in a sandy deposit below the burial zone, the direction of natural groundwater flow is upward through the till and clay into the water-table zone. The groundwater flow system will localize the contaminants in or near the soil zone. Monitoring and removal, if necessary, would be relatively simple. In the unlikely event of leakage of liquid wastes into the groundwater zone, the natural groundwater flow system will minimize the hazard by localizing the contamination at shallow depths in th waste-management area or by transporting the radionuclides at very slow rates in an underlying sandy deposit. Con-taminants in the sand could be effectively controlled or removed by a combination of natural sorption processes and well pumping. (See also W74-03222) (Knapp-USGS) W74-03239

MOVEMENT AND ACCUMULATION OF SUSPENDED SEDIMENT DURING BASIN

Southwestern Great Plains Research Center. Bushland, Tex.

For primary bibliographic entry see Field 04B.

GEOHYDROLOGY OF BURIED TRIASSIC BASIN AT SAVANNAH RIVER PLANT, SOUTH

Du Pont De Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.

I. W. Marine. In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 481-504, 1973. 4 tab, 32 ref. USAEC Contract AT (07-2)-1.

\*Hydrogeology,

waste disposal, \*South Carolina, \*Radioactive waste disposal, Radioactive wastes, Groundwater basins, Water levels.

At the Savannah River Plant near Aiken, South Carolina, high-level radioactive wastes are stored in concrete and steel tanks buried just beneath and ground surface. This waste is of such activity and longevity that it cannot be dispersed into the en-vironment, but it must be contained for periods of time extending at least into hundreds and perhaps thousands of years. One concept for the terminal containment of this waste is to store it in excavated chambers within the bedrock, which is covered by about 1,000 ft of coastal-plain sedimentary beds at the plant site. A buried Triassic basin that might have potential for waste storage was discovered beneath the southern third of the plant site. Seismic, gravity, and magnetic surveys, and the drilling of several exploratory wells, in-dicate that the Triassic basin is about 30 mi long, 6 mi or more wide, and filled with sedimentary rocks 5,300 ft thick. The rock in the basin is predominantly mudstone of very low permeability, but a nanty mudstone of very low permeability, out of few lenses of poorly sorted gritty sandstone are present. The water yield of all the exploratory wells is extremely low, and water-transmitting fractures are virtually nonexistent. In two wells within the basin, heads above land surface have been measured that cannot be explained by connection with a recharge area. Possible explanations are tectonic compression, temperature increase, and osmotic-membrane phenomena. (See also E74-03222) (Knapp-USGS)

ARTIFICIAL RECHARGE OF TREATED WASTE WATERS AND RAINFALL RUNOFF INTO DEEP SALINE AQUIFERS OF PENINSU-LA OF FLORIDA

Black, Crow and Eidsness, Inc., Gainesville, Fla. J. I. Gracia-Bengochea, C. R. Sproul, R. O. Vernon, and H. J. Woodard.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 505-525, 1973. 7 fig, 2 tab,

Descriptors: \*Waste disposal wells, \*Florida, \*Hydrogeology, Underground waste disposal, Artifical recharge, Injection wells, Waste water disposal. Identifiers: Saline aquifers.

Deep-well disposal of waste waters into deep saline aquifers, after secondary biological treat-ment and disinfection, is feasible (1) if an aquifer exists that can accept treated waste waters without significant changes in its hydraulic and structural characteristics, and (2) if use of the water in that aquifer, in adjacent ones, or from surficial sources not impaired. The peninsula of Florida, at the southeastern extremity of the continental United States, is underlain by several thousand feet of carbonate rock and only minor amounts of siliceous clastic units. Cavernous limestone and dolomite aquifers at relatively shallow depths constitute the principal sources of freshwater in the area. Deeper cavernous zones, separated from the freshwater zones by practically impermeable limestone and dolomite, are uniquely suited for receiving injected fluids. (See also W74-03222) (K-napp-USGS) W74-03242

INJECTION OF ACIDIC INDUSTRIAL WASTE INOT A SALINE CARBONATE AQUIFER:
GEOCHEMICAL ASPECTS,
Geological Survey, Tallahassee, Fla.

M. I. Kaufman, D. A. Goolsby, and G. L.

Faulkner In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 526-551, 1973. 10 fig, 5 tab,

Descriptors: \*Waste disposal wells, \*Water chemistry, \*Florida, Acidity, Sugarcane, Underground waste disposal, \*Injection wells, Oxygen demand, Path of pollutants, Water pollution effects, Carbonate rocks, Industrial wastes. Identifiers: \*Saline aquifers

A section of carbonate rocks that includes several highly permeable cavernous zones filled with saline water underlies the south part of peninsular Florida at depths from about 1,500 to 4,500 ft. Because these cavernous zones are capable of yielding or accepting large quantities of fluids, they are used for storage of industrial and municipal liquid waste at several places. One such place is at the south end of Lake Okeechobee, near Belle Glade, Florida, where the effluent from a sugar mill and liquid waste from the production of furfural processed from sugar cane bagasse have been injected at depths between about 1,500 and 2,200 ft. The waste ranges in temperature from 71 to 103 deg C and in pH from 2.6 to 4.5; it is highly organic (chemical oxygen demand, 6.000-26,000 mg/liter). Injection rates range from 400 to 800 gal/minute at pressures of 30-60 lb per sq in. Anaerobic degradation of the organic waste begins near the injection well as indicated by the presence of hydrogen sulfide, methane, carbon dioxide, and nitrogen. The waste has moved both upward and laterally in the aquifer system. When upward movement of waste was detected, injection was discontinued and the well was drilled and cased several hundred feet deeper. (See also W74-03222) (Knapp-USGS) W74-03243

HYDROLOGIC EVALUATION OF INDUSTRI-AL-WASTE INJECTION AT MULBERRY, FLORIDA.

Geological Survey, Tampa, Fla. W. E. Wilson, J. S. Rosenshein, and J. Hunn. In: Under ground Waste Management and Artificial Recharge, Vol 1, p 552-564, 1973. 4 fig, 1 tab, Descriptors: \*Waste disposal wells, Acids, \*Chemical wastes, Limestones, \*Hydrogeology, \*Florida, Industrial wastes, Aquifer characteristics, \*Injection wells.

Florida's deepest waste-injection well, completed in 1972 at a chemical plant at Mulberry, injects acid industrial waste into carbonate rock. The liquid waste has a high chloride content and a pH that is generally less than 2, and at times less than 1. The injection-well annulus has two monitor wells, one open near the base of the Floridan wells, one open near the base of the Fiornas aquifer from 1,254 to 1,264 ft, and the other open to the saline-water aquifer below the Floridan aquifer, from 2,755 to 2,788 ft. Several permeable zones are exposed in the open hole. Dissolution of limestone by the low-pH waste substantially in-creased the permeability of the rock adjacent to the well bore and increased the density and temperature of the injection fluid as it moved into the injection zone. Injection-zone transmissivity less than 800 sq ft per day. (See also W74-03222) (Knapp-USGS) W74-03244

CASE HISTORY OF SUBSURFACE WASTE IN-JECTION OF AN INDUSTRIAL ORGANIC

Geological Survey, Denver, Colo.
J. A. Leenheer, and R. L. Malcolm.
In: Underground Waste Management and Artificial Recharge, Vol 1, p 565-584, 1973. 5 fig. 5 tab, 6

Descriptors: \*Waste disposal wells, Water chemistry, "Acids, "Underground waste disposal, "Industrial wastes, "Industrial wastes, "North Carolina, Biochemistry, Chemical reactions, Iron, Carbon dioxide, Limestones, "Organic wastes, Iniection wells

From May 1968 to December 1972, an industrial organic waste was injected at rates of 100-200 gal per minute into an Upper Cretaceous sandstone, gravel, and limestone aquifer near Wilmington, North Carolina. The waste, an aqueous solution of formic, acetic, and phthalic acids, interacted with the aquifer to dissolve carbonate, aluminosilicate, and iron-containing minerals, and to produce carbon dioxide, methane, and hydrogen sulfide gases. Water samples obtained from four observation wells that penetrate the aquifer near the injection well show a 3-fold increase in silica, a 5-fold increase in iron, and a 28-fold increase in aluminum over background data, indicating dissolution of minerals. Gas that effervesced from these water samples contained up to 85% carbon dioxide by volume. Water samples obtained from a observation well 1,500 ft north of the original injection wells gave evidence for biochemical waste transformations during passage of the waste front. Gas that effervesced from these water samples contained up to 54% methane by volume. Ferrous iron concentrations as high as 35 mg per liter, hydrogene sulfide gas, and sulfide precipitates were additional indicators of biochemical reductive processes. (See also W74-03222) (Knapp-USGS) W74-03245

ROLE OF BACTERIA IN DECOMPOSITION OF INJECTED LIQUID WASTE AT WILMINGTON, NORTH CAROLINA, North Carolina State Univ., Raleigh. Dept. of

Microbiology.
For primary bibliographic entry see Field 05B.
W74-03246

HISTORY OF A TWO-WELL INDUSTRIAL--WASTE DISPOSAL SYSTEM, Bureau of Mines, Bartlesville, Okla. Bartlesville Energy Research Center. E. C. Donaldson, and R. T. Johansen.

# WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

## Ultimate Disposal of Wastes-Group 5E

In: Underground Waste Management and Artificial Recharge, Vol 1, p 603-621, 1973, 8 fig. 3 tab, 2

Descriptors: \*Waste disposal wells, \*Injection wells, \*Underground waste disposal, \*Industrial wastes, Organic compounds, Organic wastes.
Identifiers: \*Two-well waste injection.

A two-well waste injection system has been in operation since 1964. The major constituents of the wastes are phenol, 1-butanol, butanal, and nhexylamine. The advance of the waste constituents is retarded by adsorption; thus, at the advancing front a zone develops that is depleted of waste constituents. The depth of this zone increases as more of the formation is invaded by the injected fluid. Injection of the industrial wastes in the two-well system solved a very difficult wastedisposal problem. The two noncompatible wastes andled with a minimum of surface treatment by using a two-well system. (See also W74-03222) (Knapp-USGS) W74-03247

SUBSURFACE DISPOSAL OF WASTE IN KAN-

SAS, Kansas State Dept. of Health, Topeka.

In: Underground Waste Management and Artifi-cial Recharge, Vol 1, p 622-633, 1973. 1 fig, 1 tab.

Descriptors: \*Waste disposal wells, \*Kansas, Regulation, \*Industrial wastes, Oil fields, Brines, \*Underground waste disposal, \*Injection wells.

The use of wells for the subsurface disposal of wastes has been practiced in Kansas since 1935. All of the early waste-disposal wells were used to dispose of oil-field brine. Permits for the first in-dustrial-waste disposal wells other than oil-field wells were issued in 1952. Before using a well for the subsurface disposal of oil-field or gas-field brines, the operator must submit plans and specifications for each disposal well to the Kansas State Corporation Commission. Before using a well for the subsurface disposal of industrial wastes other than oil-field or gas-field wastes, an application must be filed with, and a permit issued by, the Kansas State Department of Health. At present, there are 3,200 approved oil-field and gas-field saltwater-disposal wells in use, receiving a total of about 3.5 million bbl of salt water per day. There are 30 industrial-waste disposal wells at 20 plants in the state which include 10 LPG undergroundstorage projects, two salt companies, two petroleum refineries, four natural-gas compressor stations, one chemical-manufacturing plant, and one fertilizer plant. Most industrial waste being disposed of in the subsurface consists of salt brine. Experience with both industrial and oil-field disposal wells shows that most operational problems are caused by (1) selection of an injection zone with inadequate permeability, (2) lack of preliminary waste treatment or inadequate treatment, or (3) failure to provide an effective main-tenance program. (See also W74-03222) (Knapp-USGS) W74-03248

SITE INVESTIGATIONS FOR A BEDDED-SALT Oak Ridge National Lab., Tenn.
T. F. Lomenick, and A. L. Boch.

In: Underground Waste Management and Artificial Recharge, Vol 1, p 634-651, 1973. 12 fig, 1 tab, 11 ref.

Descriptors: \*Underground waste disposal, \*Radioactive waste disposal, \*Nuclear wastes, \*Aquicludes, \*Kansas, Hydrogeology, Salts, Groundewater movement, \*New Mexico.
Identifiers: \*Salt mines, Bedded salt, Rock salt.

High-level radioactive waste contains long-lived nuclides that require complete confinement for long periods of geologic time. Rock salt is the preferred geologic medium for the ultimate disposal of these wastes as its unique self-healing properties make it impervious to the circulation of groundwaters. Site studies were made in the Permian basin and, in particular, in central Kansas and in a large tract of federally owned land in southeastern New Mexico. A series of coreholes was drilled to provide data for selecting disposal levels and for assessing the hydraulic characteristics of the overlaying formations. Measurements of the physical properties of these rocks were made to calculate their deformational behavior. The Permian basin should continue to be tectonically stable for the next few hundreds of thousands of years or for the effective lifetime of the wastes. Present rates of denudation in central Kansas average less than 1 ft per 1,000 years and stream incisions in the same area during Quaternary time have not exceeded several hundred feet. The buried wastes would not be adversely affected by the advance of a new continental ice sheet. (See also W74-03222) (Knapp-USGS) W74-03249

DEEP-WELL INJECTION OF DESALTING-PLANT WASTE BRINE,

Illinois State Water Survey, Urbana. R. J. Schicht

In: Underground Waste Management and Artificial Recharge, Vol 1, p 652-657, 1973. 6 ref.

Descriptors: \*Waste disposal wells, \*Brines, \*Desalination wastes, \*Illinois, Hydrogeology, Injection wells, Path of pollutants, \*Sandstones. Identifiers: Mount Simon Sandstone.

Desalting of saline waters stored in a deep artesian aquifer in northeastern Illinois (the Mount Simon Sandstone) is being considered. It would be necessary to dispose of large quantities of desaltingplant waste brine. Evaluation of brine-disposal methods led to selection of disposal by injection through wells open to the lower Mount Simon aquifer. Injection-well fields were designed to eliminate contamination of feedwater and to keep injection pressures within acceptable limits. Wells ere designed to be capable of injecting 1 million gal per day. Injection costs range from 17 cents per 1,000 gal for injection of brine from a 1-mgd reverse-osmosis plant to 35 cents per 1,000 gal for brine from a 5-mgd distillation plant. Waste-brine injection may have a harmful effect on the quality of water withdrawn from existing wells open to the aquifers above the Mount Simon (See alsw W74-03222) (Knapp-USGS) W74-03250

EFFECT OF FORMATION DIP ON THE MOVE-MENT OF FRESH WATER STORED IN SALINE

Petroleum Engineering. For primary bibliographic entry see Field 04B. W74-03336 Louisiana State Univ., Baton Rouge. Dept. of

ARTIFICIAL RECHARGE-STATE OF THE

Geological Survey, Lubbock, Tex. For primary bibliographic entry see Field 04B. W74-03354

INDUSTRIAL WASTEWATER-INJECTION WELLS IN UNITED STATES-STATUS OF USE AND REGULATION, 1973, Missouri Univ., Rolla. Dept. of Geological En-

gineering. D. L. Warner, and D. H. Orcutt.

In: Underground Waste Management and Artifi-cial Recharge, Vol 2, p 687-697, 1973. 8 tab, 5 ref.

Descriptors: \*Waste disposal wells, \*Injection wells, \*Regulation, \*Underground waste disposal, \*Reviews, Legislation, Water law, Hydrogeology, Path of pollutants, Water pollution effects, \*U-

As of mid-1973, at least 278 industrial wastewaterinjection wells had been constructed in 24 states, and 170 of these wells were operating. The chemical industry is the largest user of injection wells. The total depth of existing wells ranges from less than 1,000 ft to over 12,000 ft, but most are between 1,000 and 6,000 ft deep. Ninety-five perbetween 1,000 and 6,000 ft deep. Ninety-five per-cent of existing wells have average injection rates of less than 400 gpm and 99% inject at average well-head pressures of less than 1,500 psi. Nintey-six percent of existing wells are completed in un-consolidated sand, sandstone, or carbonate zones, which range in age from Cambrian to Quaternary. There are few instances of reported contamination of fresh groundwater and no reported instances of degradation of other resources. A few states have developed specific laws and regulations for dealing with wastewater injection. Some recommended policies, laws, and procedures have been developed at the Federal and Interstate level. (See also W74-03222) (Knapp-USGS) W74-03355

ARTIFICIAL RECHARGE OF COASTAL-PLAIN AQUIFER IN ISRAEL, Tahal Consulting Engineers Ltd., Tel Aviv (Israel). Div. of Hydrology. For primary bibliographic entry see Field 04B. W74-03356

HAZARDS OF WASTE DISPOSAL IN GROUND-WATER BASINS.

Geological Survey, Sacramento, Calif. B. E. Lofgren.

In: Underground Waste Management and Artificial Recharge, Vol 2, p 715-728, 1973. 4 fig, 9 ref.

Descriptors: \*Underground waste disposal, \*Hydrogeology, Aquifers, Aquicludes, Aquifer characteristics, Radioactive waste disposal, Industrial wastes, Path of pollutants, Water pollution effects. Water pollution sources.

Isolated zones in groundwater basins are being considered as burial grounds for hazardous wastes. Unconsolidated deposits, even at great depth, are highly sensitive to changes in applied stress. Interstitial fluids may be squeezed from even relatively impermeable beds by modest stress changes. Hydraulic stresses in a developing groundwater basin may affect beds considerably below the deepest pumping wells. Theoretically, seepage stresses, and thereby groundwater movement, ultimately would affect all beds down to basement or some underlying truly impermeable layer. Slow drainage from each interbed continues as long as excess pore pressure exists in that in-terbed. Injection of wastes into clay or shale interbeds would cause a sharp increase in pore pressure in these interbeds. Depleted artesian aquifers are not empty reservoirs ready for refilling. Rather, the groundwater systems are fully saturated and are adjusting to the various stresses imposed on the basin. Horizontal and vertical ground move-ment, caused by horizontal and vertical groundwater flow, can be a serious threat to surface or buried structures. Saline-water bodies in a basin are not necessarily permanently isolated from the freshwater circulation system. Evidence suggests that upward seepage stresses sometimes extend below the freshwater-saline water interface; thus, in some areas saline water may be moving upward into the freshwater zones. Few regions of a groundwater basin are isolated from the circulating flow system. Long-lived radioactive wastes require isolation from the hydrosphere for periods of time ranging from 1,000 to several hundreds of thousands of years, and some waste materials must be contained forever. (See also W74-03222) (Knapp-USGS)

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W74-03357

ASSE SALT MINE, FEDERAL REPUBLIC OF GERMANY--OPERATING FACILITY FOR UNDERGROUND DISPOSAL OF RADIOACTIVE WASTES.

WASTES, Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg bei Munich West Germany. Institut fuer Stratigraphie.

In: Underground Waste Management and Artificial Recharge, Vol 2, p 741-766, 1973. 6 fig, 3 tab,

Descriptors: Underground waste disposal, Radioactive waste disposal, Salts, Mining, Hydrogeology, Monitoring. Identifiers: Rock salt, Salt mines, Germany (Federal Republic).

All investigations for the disposal of radioactive wastes originating from the different nuclear activities in Germany, mainly nuclear research and power production, were intended to find a place where the wastes are excluded from the biosphere for the time necessary for their decay; therefore, research and development work was concentrated on salt formations. Because the salt deposit in the Asse mine is in the form of an anticline, a total of about 130 rooms was created on 13 different levels by a special type of room-and-pillar mining system. Test disposal of low-level radioactive wastes was started in April 1967. Solid or solidified wastes, packed in 200-liter drums, are stacked in the rooms. Those rooms filled with low-level wastes are sealed off. At present a total of about 22,000 drums has been disposed of. In August 1972, disposal of intermediate-level radioactive wastes was started. The environment of the mine is thoroughly monitored. Total capital investments amount to about 18 million Deutsche mark to date. Operating costs are about 2 million Deutsche mark a year, including staff and scientific personnel. (See also W74-03222) (Knapp-USGS) W74-03358

DAN REGION, ISRAEL, SEWAGE-RECLAM-ATION AND RECHARGE PROJECT, Tahal Consulting Engineers Ltd., Tel Aviv (Israel). Div. of Hydrology. For primary bibliographic entry see Field 05D. W74-03359

LABORATORY FACILITY FOR STUDIES RE-LATED TO ARTIFICIAL RECHARGE, Geological Survey, Lubbock, Tex. For primary bibliographic entry see Field 04B. W74-03360

HYDROGEOLOGY OF SUBSURFACE LIQUID-WASTE STORAGE IN FLORIDA, Geological Survey, Tallahassee, Fla. H. S. Puri, G. L. Faulkner, and G. O. Winston. In: Underground Waste Management and Artificial Recharge, Vol 2, p 825-850, 1973. 11 fig, 14 ref.

Descriptors: \*Underground waste disposal, \*Florida, \*Hydrogeology, \*Waste disposal wells, Karst, Stratigraphy, Injection wells, Aquicludes, Industrial wastes, Sewage disposal, Limestones, Aquifer characteristics, \*Liquid wastes.

Liquid wastes are being injected into deep, saline, carbonate aquifers in Florida. The wastes, including acidic, high-oxygen-demand industrial-plant effluents, are injected into permeable saline zones separated from shallower freshwater aquifers by confining layers. At a site near Pensacola, in west Florida, acidic liquid waste has, for nearly 10 years, been injected into a 1,400- to 1,700-ft deep, moderately permeable carbonate zone separated from shallower freshwater aquifers by a widespread, 200-ft thick, nonpermeable, plastic clay. The pressure effects of this injection now ex-

tend outward more than 30 mi. The waste has improved the permeability of the injection zone near the injection well by dissolution of the limestone. There is no evidence that either the confining layer or the overlying carbonate aquifer has been ad sely affected by the injection. In the south part of peninsular Florida, the aquifer used for waste storage consists almost entirely of carbonate rocks, in part anhydritic. Secondary sewage-plant effluent has been injected for about 2 years into a highly cavernous limestone at a depth of about 3,000 ft in the Miami area with only a slight bottom-hole pressure increase. Neither the quality of the water nor the pressure in the overlying permeable zones has been affected. Hot acidic waste injected at a depth of about 1,500 ft in northwestern Palm Beach County migrated upward to a shal-lower permeable zone. The injection well was subsequently drilled deeper and cased to about 2,000 ft to confine the waste to the injection zone. (See also W74-03222) (Knapp-USGS) W74-03361

FEASIBILITY STUDY OF LIQUID-WASTE IN-JECTION INTO AQUIFERS CONTAINING SALT WATER, WILMINGTON, NORTH CAROLINA.

SALT WAIER, WALLIAM CAROLINA,
North Carolina Dept. of Natural and Economic
Resources, Wilmington. Office of Water and Air
Resources.

H. M. Peek, and R. C. Heath.
In: Underground Waste Management and Artificial Recharge, Vol 2, p 851-875, 1973. 12 fig, 1 tab, 5 ref.

Descriptors: \*Waste disposal wells, \*Underground waste disposal, \*Hydrogeology, \*North Carolina, Industrial wastes, Monitoring, Waste treatment, Waste water treatment, Waste water disposal, \*Liquid wastes. Identifiers: Wilmington (NC).

An experimental system to inject liquid waste into relatively shallow sedimentary aquifers containing saltwater was installed at Wilmington, North Carolina, and placed in operation in the spring of 1968. The initial system consisted of one injection well and three observation wells completed between depths of 850 and 1,050 ft, and one observation well completed in the next higher aquifer at a depth of about 700 ft. Injecting the byproduct from dimethyl terephthalate at the rate of about 300,000 gal per day, the initial system of wells failed because of construction and operational problems in addition to hydrogeologic conditions unfavorable to injection. A new injection well was installed in operation in January 1971, along with part of a new monitor-well system. Because of the unfavorable hydrologic conditions and the failure of some wells which permitted leakage into overlying aquifers a conventional waste-treatment facilias constructed to replace the injection system in 1972, and injection of waste ceased in November 1972. About 20-90 gpm of water was injected until the end of March 1973, when the system became inactive except for monitoring. (See also W74-03222) (Knapp-USGS) W74-03362

HYDROGEOLOGIC CONSIDERATIONS IN LAND SPREADING OF SEWAGE TREAT-MENT-PLANT EFFLUENT IN CENTRAL FLORIDA, Geological Survey, Winter Park, Fla. Water Resources Div. For primary bibliographic entry see Field 05D.

W74-03518

RENOVATING SEWAGE EFFLUENT BY GROUND WATER RECHARGE, Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab. For primary bibliographic entry see Field 05D. W74-03520 ENGINEERING DESIGN CRITERIA FOR SPRAY IRRIGATION, Bishop (William), Tallahassee, Fla. For primary bibliographic entry see Field 05D. W74-03521

# 5F. Water Treatment and Quality Alteration

LOOK, NO CLARIFIER,
Mississippi Power and Light Co., Vicksburg.
J. E. Burguet, and M. R. Hutson.
In: Proceedings of 8th Mississippi Water
Resources Conference, April 10-11, 1973, p 87-98,
1973. 2 fig, 3 tab, 3 ref.

Descriptors: \*Water quality control, \*Electric powerplants, \*Boilers, \*Turbines, \*Filters, Economics, Costs, Reviews, Evaluation, Operation costs, Operation and maintenance, \*Water treatment. Identifiers: Up flow filters.

Modern powerplants require very pure water. Generally, distilled water is not pure enough. The use of ion exchange equipment is a must as the pressure and temperature of modern plants progressively increases with every new boiler/turbine generation. Normally, the water in supercritical boilers must have over 50 part per billion toal contaminants. Under actual normal operating conditions this usually runs between 10 to 12 parts per billion. In order to accomplish this type of purity, boiler makeup water passes through strong acid cation exchanger and a strong base anion exchanger. Resins used in these ion exchange units average \$25.00/cu ft for cation to \$65.00/cu ft for the anion resins, making an investment of some \$12,000. Replacement of this resin is generally assumed at 100% every 5-7 years. At Baxter Wilson Steam Electric Station in Mississippi, due to the excessive chlorine in the water, two loads of resin were damaged at a cost of \$24,000 in a period of three years. The use of an up flow filter has demonstrated the feasibility of producing Mississippi River water of equal or better effluent quality than clarifier. Evaluations are made of up flow filters made by three major manufacturers, each with their own patented devices that, in general, reflect the firm's particular philosophy of accomplishing the job. (See also W74-03212) (Woodard-USGS)

VIRUS REMOVAL IN HAWAIIAN SOILS, Hawaii Univ., Honolulu. R. H. F. Young, and N. C. Burbank, Jr. Journal American Water Works Association, Vol 65, No 9, Part 1, p 598-604, September 1973. 9 fig, 2 tab, 35 ref.

Descriptors: \*Viruses, \*Soils, Efficiencies, \*Percolating water, \*Leaching, Retention, \*Hawaii, Bacteriophage, Soil types, Subsoil, Percolation, Laboratory tests, Seepage, Cesspools, Groundwater, Water quality control, Water supply, \*Path of pollutants, Sampling, Adsorption, \*Water treatment.

Identifiers: Lactosols, Volcanic cinder, Pollutant removal, Wahiawa soil, Lahaina soil, Poliovirus II, Coliphage T4, Tantalus cinder.

Three types of Hawaiian soils (Wahiawa, Lahaina and Tantalus) were used in laboratory studies in percolation columns to determine the extent of travel or possible breakthrough of viruses into the underlying source of water supply. The viruses used were a coliphage T4 BII mutant, and poliovirus Type II (Lansing) H8. The columns containing the selected soils were subjected to intermittent percolating water with a known concentration of virus, simulating the action of a cesspool leaching into the ground. The effluent from the soil column was collected and analyzed for viral content by plaque-forming techniques. The Wahiawa

and Lahaina soils were 100 percent effective in the retention or adsorption of bacteriophage T4 from percolating water at the applied concentration of 2.5 million/ml of feed solution at depths of 6 and 2.5 in. Breakthrough of the bacteriophage oc curred immediately in both soils for the 1.5-in.deep soil columns at an applied concentration of 1.5 million/ml of feed solution. The Tantalus cinder subsoil proved ineffective in holding the bacteriophage at the recorded thicknesses of 15. 12, and 6 in. at the applied concentration 1.5 million/ml of feed solution. The breakthrough concentration was 5000,000/ml. Percolation tests with Wahiawa and Lahaina soils and Tantalus cinder demonstrated that short soil columns did not completely remove poliovirus Type II from percolating water when the virus was applied at a dosage of 150,000 pfu/ml. Breakthrough occurred immediately for the 1 1/2- and 2 1/2-in. soil columns. Results with Tantalus cinder dosed at 150,000 pfu/ml of poliovirus Type II demonstrated very low virus retention. (Holoman-Battelle) W74-03293

IDENTIFICATION AND INCIDENCE OF KLEB-SIELLA IN CHLORINATED WATER SUP-

Chicago Dept. of Water and Sewers, Ill. Water Purification Div.

For primary bibliographic entry see Field 05A. W74-03294

A MATHEMATICAL MODEL FOR OPTIMUM DESIGN AND CONTROL OF METROPOLITAN WASTEWATER MANAGEMENT SYSTEMS, Battelle-Pacific Northwest Labs., Richland,

For primary bibliographic entry see Field 05D. W74-03468

EMPHASIZING QUALITY CONTROL,

Seattle Dept. of Water, Wash.

J. Courchene, A. Smythe, and A. Wallace.

Journal of the American Water Works Association, Vol 65, No 11, p 743-745, November, 1973. 1

tab, 2 photos, 3 ref.

Descriptors: \*Water quality control, \*Water treatment, Quality control, Water quality, \*Water storage, \*Water distribution (Applied), Chlorination. Groundwater mining. Identifiers: Flushing, Free chlorine residuals.

Quality control is part of the price of doing business and the water industry is no exception to this rule. Accordingly, practices are outlined to maintain water quality by source protection, treatment, and care in storage and distribution. Seven quantitative indexes of water quality are proposed. Surface waters are subject to pollution from lumber ing, livestock grazing, agriculture, recreation, and domestic or industrial wastes. Continuous water source surveillance is necessary, together with land use and subdivision controls near shorelines. Groundwaters are subject to different problems of quality control than surface waters; watertight casings should line all wells to the depth of the first impervious rock formation. There should be continuous chlorination of water supplies, even without evidence of bacterial pollution. Frequent sampling of treated water is urged. Methods are suggested for keeping small animals and birds out of stored water. To protect water from contamination in mains, chlorine should be introduced so as tion in mains, chorine should be introduced so act to result in a free chlorine residual of at least 50 ppm for 24 hours. After 24 hours, the chlorine residual should be at least 25 ppm if there is a sufficiently low bacteria count in the main. Regular flushing, electronic and sonic leak detection, following up customer complaints, and checking for cross-connections of sewerage lines with water lines are other practices recommended for main-taining water quality. (Stein - North Carolina) W74-03636

FILTRATION SYSTEM FOR LIQUIDS. Coleco Industries, Inc., Hartford, Conn. (as-

signee).

U.S. Patent No 3,767,050, 5 p, 8 fig, 5 ref; Official Gazette of the United States Patent Office. Vol 915, No 4, p 1294, October 23, 1973.

Descriptors: \*Patents, \*Swimming pools, \*Filtra-tion, \*Water treatment, Water quality control, Recreation facilities, Waste water treatment.

A filtration system for liquids employs a sealed tank that is partially filled with sand or the like to provide a filtration bed in the lower portion. An underdrain device is buried in the bed of sand and prevents particles from passing out from the bed with the liquid flowing through the system. One end of a vent conduit is attached to the underdrain device from which it passes up through the sand to a point near the top of the tank. Air introduced into the tank escapes automatically through the vent conduit, thus eliminating the need for the valves conduit, thus eliminating the need for the valves which are conventionally provided in the upper portion of such tank filters for the same purpose. The filtration system includes a particulate or sand filter unit coupled with a fabric type filter to remove very fine particles from the liquid removed from the liquid treated in the sand filter removed from the liquid treated in the sand filter unit. The system is particularly adapted for use with swimming pools, and is capable of removing very fine particles from water flowing at high rates through the system. (Sinha - OEIS) W74-03662

## 5G. Water Quality Control

PROCEEDINGS, MISSISSIPPI WATER RESOURCES CONFERENCE, 1973.
Mississippi State Univ., State College. Water
Resources Research Inst. For primary bibliographic entry see Field 05B. W74-03212

MATHEMATICAL MODELING OF WATER

QUALITY, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 05B. W74-03217

MULTIPLE OUTLET SELECTIVE WITHDRAWAL TECHNIQUE FOR WATER QUALITY PREDICTION OF LAKE RELEASES, Army Engineer Waterways Experiment Station, Vicksburg, Miss. For primary bibliographic entry see Field 05B. W74-03218

UNDERGROUND WASTE MANAGEMENT AND ARTIFICIAL RECHARGE, VOLUMES 1 AND 2. American Association of Petroleum Geologists, For primary bibliographic entry see Field 05E. W74-03222

WATER LAW AND ITS RELATIONSHIP TO ENVIRONMENTAL QUALITY: A BIBLIOG-RAPHY OF SOURCE MATERIAL,

Colorado State Univ., Ft. Collins. Dept. of

G. Radosevich, D. Allardice, G. Swanson, and K.

Available from the National Technical Informa-Available from the National Technical Informa-tion Service as PB-226 816, \$4.50 in paper copy, \$1.45 in microfiche. Colorado Environmental Resources Center, Ft. Collins, Information Series No. 6, February 1973. 126 p. OWRR C-3107 (No

Descriptors: \*Legal aspects, \*Laws, \*Bibliographies, \*Publications, \*Habitats, \*Aesthetics, \*Recreation, Wildlife habitat, \*Water law.

A bibliography is presented of legal, institutional and related source materials on the subject of water law in relationship to environmental quality and of related discussions of the natural resource aspects of water resources. These resource publi-cations, often based upon research or inventories, form in general the background for the laws and regulations. The topic has been narrowed so that specific emphasis is on fish and wildlife habitat nd recreational and aesthetic aspects. In the traditional sense of water law, only quantity charac-teristics of water are covered. This project and bibliography have also confined the field of ex-amination to water quantity considerations. Water quality and pollution control are already in-vestigated in previously completed bibliographies. The approach has been to divide the sources into the broad categories of state materials, interstate or regional materials, and federal materials. Each of these areas is broken down into legal relating to water, legal relating to fish and wildlife and natural resources reports. Customary classifications and listing of legal data sources have been utilized to rank the citation. The sources contained in the bibliography are not annotated. (Sears-Florida) W74-03322

POLITICAL AND ENVIRONMENTAL AT-TITUDES OF VOTERS AND PUBLIC OFFI-CIALS RELATED TO ALTERNATIVE LEVELS OF WATER QUALITY AND CORRELATIVE LEVELS OF MANAGEMENT OF THE PENOB-SCOT RIVER,
Maine Univ., Orono. Dept. of Political Science.

J. S. Henderson.

Available from the National Technical Informa-tion Service as PB-226 770, \$4.50 in paper copy, \$1.45 in microfiche. August 3, 1973. 120 p, 12 fig, 35 tab. OWRR A-025-ME (1).

Descriptors: \*Political aspects, \*Governments, \*Local governments, \*State governments, \*Employment, \*Water pollution, Legislation, Legal aspects, Pollution abatement, State jurisdiction, Environmental effects, \*Maine, Pollution taxes (Charges).
Identifiers: Effluent charge concept, Penobscot

This project was conducted to determine public attitudes concerning political aspects of environ-mental control. An opinion survey of registered voters and elected local officials in the Penobscot voters and elected local officials in the Penosocal Project area revealed agreement that pollution is the major issue facing Maine and that current anti-pollution laws are inadequate. A similar survey of members of the 105th Maine Legislature showed them divided on the importance of the issue, and generally content with present anti-pollution legislation. All groups were optimistic about restoring the river to a good condition in about 20 restoring the river 'to a good condition in about 20 years'. Large majorities reject loss of employment as a bar to pollution control programs. Strong good for those surveyed. The 'effluent charge' concept is overwhelmingly supported by voters and local officials, while legislators are divided. No single, dominant 'cause-and-effect' perception of Penoberot substitutions in the contraction of the contraction o scot pollution exists among voters. (Sears-Florida) W74-03323

USER ATTITUDES TOWARD WATER QUALI-TY AND PRICE, LAS VEGAS VALLEY AND RENO-SPARKS, NEVADA,

Nevada Univ., Reno. Desert Research Inst. L. Reichert, and J. Leland.

L. Reichert, and J. Leiand.
Available from the National Technical Information Service as PB-226 876, \$9.50 in paper copy, \$1.45 in microfiche. Report October 1971. 121 p, 3 fig. 6 tab, 25 ref, 6 append. OWRR A-036-NEV (1), OWRR A-036-NEV (2).

Descriptors: \*Attitudes, \*Water quality, \*Testing procedures, Social values, Water demand, Statistical methods, Data collection, \*Nevada, Costs. Identifiers: Reno (Nev), Sparks (Nev), Las Vegas

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5G-Water Quality Control

While there is much discussion on water quality. little is known about what people will pay for varying levels of water quality. A pilot project is presented which develops and pretests a questionnaire in Nevada's two main urban centers, Reno-Sparks and Las Vegas, to evaluate variables which may affect people's valuation of water quality. The personal interview questionnaire centers on: (1) source and quality of household water; (2) respondent's attitude towards water treatment, inside and outside the household; (3) price of water to household; (4) damages resulting from varying water quality; (5) respondent's expected change in water use given a change in price; and (6) respondent's knowledge and attitudes towards water pollution and supply. High and low quality and cost areas are identified in the region. Respondents are classified according to a modified Warner Index of Characteristics. Relationships hypothesized between water use and designated independent variables, including quality, cost and status. Problems of sampling and generalizing from samples are discussed. A preliminary version of the interview questionnaire is listed, and a number of the questions and responses are briefly summarized. (Schroeder-Wisconsin) W74-03331

PROPOSED MUNICIPAL WASTE WATER--GROUNDWATER EXCHANGE, CITY OF TUCSON: AVRA-MARANA VALLEY. Arizona Water Resources Research Center, Tuc-

son; and Arizona Agricultural Experiment Station,

Available from the National Technical Information Service as PB-226 910, \$4.00 in paper copy, \$1.45 in microfiche. University of Arizona Colle of Agriculture Publication, 1971. 7 p, 2 tab. OWRR A-022-ARIZ (3).

Descriptors: \*Municipal wastes, \*Irrigation, Groundwater resources, Water supply, Arizona, Water quality, Water utilization, Agriculture, Methodology.

Identifiers: \*Water exchange system, Tucson

(Ariz), Avra Valley (Ariz).

The city of Tucson, Pima County, Arizona, and agricultural interests in the Avra Valley have an opportunity to work together for their own benefit and that of the entire community. University of Arizona Water Resources Research Center and the Agricultural Engineering Department have proposed a plan for treated waste water produced by the Tucson metropolitan area to be allocated to farmers in the Avra-Marana area in exchange for groundwater now used for irrigation. The waste water would be used only on land presently under irrigation. Scientists from the University of Arizona College of Agriculture have studied the use of Tucson municipal waste water for irrigation of crops and report favorable results. The Avra Valley groundwater is of high quality for municipal use. The proposed exchange project is compatible with the Central Arizona Project (CAP). The same distribution system built to carry treated municipal waste water could be designed to carry a mixture of CAP water and waste water to the irrigated areas of Arva Valley. The CAP water c ould either be replaced by waste water as the municipal demand increased, or exchanged for groundwater which, unlike CAP water, requires no additional treatment for municipal use. (Woodard-USGS) W74-03340

TIDAL INLETS FOR PRESERVATION OF ESTUARIES,

Lockwood, Andrews and Newnam, Inc., Houston, Tex For primary bibliographic entry see Field 02L. W74-03342

TOWARD ENVIRONMENTAL SANITY. Environmental Protection Agency, Washington, W D Ruckelshaus

J Environ Qual. Vol 1, No 3, p 275-278. 1972. Identifiers: \*Environmental protection, Laws, Noise, Pesticides, \*Pollution abatement, Radiation, Solid wastes, \*Water pollution control, Potable water, \*Federal agencies.

Growing national demand for environmental controls led to establishment of the Environmental Protection Agency (EPA) which is charged with planning and executing an integrated, coordinated attack on environmental problems of air and water pollution, drinking water quality, solid wastes management, pesticides, radiation and noise. Other Federal agencies also play a part in environmental control. A strong EPA regional organiza-tion was established. Progress is being made toward pollution control in a number of areas, but much more remains to be done. One emphasis of EPA program is on research and demonstration to combat present problems and to help anticipate future problems. Pollution control standards and laws must be enforced energetically or little will be gained. Continued public support of national, state and local environmental control programs is basic to success .-- Copyright 1973, Biological Abstracts, W74-03346

INDUSTRIAL WASTEWATER-INJECTION WELLS IN UNITED STATES-STATUS OF USE AND REGULATION, 1973, Missouri Univ., Rolla. Dept. of Geological En-

gineering.
For primary bibliographic entry see Field 05E. W74-03355

CORPORATE IMMUNITY FROM PROSECU-TION UNDER THE FEDERAL WATER POLLU-TION CONTROL ACT.

Texas Law Review, Vol 51, No 1, p 155-163, December 1972. 8 p, 43 ref.

Descriptors: \*Federal Water Pollution Control Act, \*Texas, \*Rivers and Harbors Act, \*Water Ouality Act, \*Oil spills. Water pollution control. Pollutants, Chemical wastes, Legislation, Legal aspects, Judicial decisions, Water sources, Oil pollution, Water pollution. Identifiers: \*Immunity. Water pollution

As part of the federal effort to stop water pollution, the Water Quality Improvement Act requires the 'person in charge' of a vessel or other facility to notify the Coast Guard of any oil discharge into neighboring waters, and further provides that information thus obtained cannot be used in any criminal case against the person making the report. Most criminal prosecutions for water pollution arise under the Rivers and Harbors Act of 1899 which makes the unauthorized discharge of 'refuse matter' into navigable water unlawful. The result of the juxtaposition of the two statutes is that if the court finds that the 'person in charge' of the facility did in fact make the report, the statutory immunity of the Water Quality Act prevents prosecution. In the case discussed, the 5th Circuit Court concluded that a 'person' may be a cor-porate entity and that the owner-operator of a facility is 'in charge' of the facility. The conclusions were reached in spite of the fact that the legislative history indicates that 'person' refers only to natural persons. Thus corporate polluters are given a ready escape which will hinder federal land state antipollution efforts. (McKnight-Florida) W74-03376

THE DRAFT UNITED NATIONS CONVENTION ON THE INTERNATIONAL SEABED AREA -AMERICAN BAR ASSOCIATION POSITION. American Bar Association, Washington, D.C. Natural Resources Law Section. For primary bibliographic entry see Field 06E.

PRIVATE COMPENSATION FOR INJURIES SUSTAINED BY THE DISCHARGE OF OIL FROM VESSELS ON THE NAVIGABLE WATERS OF THE UNITED STATES: A SUR-

VEY, Port of Miami, Fla.

T. R. Post.

Journal of Maritime Law and Commerce, Vol 4, No 1, p 25-65, October 1972. 41 p., 206 ref.

Descriptors: \*Oil pollution, \*Oil spills, \*Compensation, \*Legal aspects, \*Water Quality Act, Federal government, Water pollution, Legislation, Common law, Constitutional law, International law, Judicial decisions, Jurisdiction, Negligence, Penalties (Legal), Trespass, Navigable waters. Identifiers: \*Legal liability, \*Refuse Act of 1899, \*Nuisance (Legal aspects), Unseaworthiness.

This study examines the methods by which private persons may seek compensation for damages they sustain as a result of the discharge of oil from ves-sels on the navigable waters of the United States. The sources of maritime oil discharges, the trend toward increasing tanker sizes and the effects of oil discharges are reviewed. The basis upon which liability may be asserted is discussed. Compensation based on concepts of tort liability such as trespass, negligence, nuisance, and unseaworthiness may in certain circumstances be had. Compensation may also be based upon certain federal anti-pollution statutes such as the Water Quality Improvement Act of 1970 and the Refuse Act of 1899. Although the current federal anti-pollution statutes which prohibits oil pollution on the navigable waters of the United States do not explicitly provide for private civil relief, it has been suggested that implied causes of action may nevertheless be available to oil pollution claimant on the basis of some of these statutes. Compensation may also be based upon state anti-pollution statutes. The possibilities of compensation based upon international conventions is discussed. Several alternatives to the existing federal laws are proposed. (Reed-Florida) W74-03378

**ENVIRONMENTAL LAW - WATER POLLU-**TION REMEDIES - USE OF PUBLIC NUISANCE THEORY IN SUIT BY FEDERAL GOVERN-MENT - UNITED STATES V. IRA S. BUSHEY AND SONS, INC.,

G. H. Barnes.

Boston College Industrial and Commercial Law Review, Vol 14, 767-785, April 1973. 19 p, 103 ref.

Descriptors: \*Water pollution, \*Pollution abatement, \*Legal aspects, \*Interstate, Oil spills, Judicial decisions, Water pollution sources, Oil wastes, Oil water, Oil industry. Identifiers: Nuisance (Legal aspects).

The United States sought permanent injunctive relief in federal district court to prevent defendant corporations from conducting their oil transport operations without complying with certain safety procedures designed to minimize the danger of future oil spills and leakages. In the subject case the court held that in a suit brought by the federal government, a complaint alleging pollution in violation of the Refuse Act states a claim upon which relief may be granted under the federal common law of public nuisance. This article traces the background of public nuisance, examining its traditional scope and problems associated with its use. The history of the protection of interstate and navigable waters is explored, noting the use of

### WATER QUALITY MANAGEMENT AND PROTECTION—Field 05

Water Quality Control—Group 5G

public nuisance to protect these waters. This article then considers and evaluates the discussion of the doctrine of public nuisance by the court in the instant case in its denial of defendants' motion to dismiss. An attempt is made to resolve the issues raised in the case by suggesting an alternative ground for the decision, predicated on the conclusion that the public nuisance doctrine was misused by the court. (Sears-Florida) W74-03381

COURSE OF ACTION UNDER FEDERAL COM-MON LAW FOR POLLUTION OF INTERSTATE WATERS.

Dickinson Law Review, Vol 77, 451-458, Winter 1973. 8 p. 68 ref.

Descriptors: \*Water pollution, \*Pollution abate-Descriptors: "water poliution, "Foliution abate-ment, "Legal aspects, "Interstate, "Lake Michigan, Governmental interrelation, Judicial decisions, United States, Common law, Municipal wastes, Water quality, Wisconsin, Illinois. Identifiers: Nuisance (Legal aspects).

The U.S. Supreme Court in the subject case established a cause of action in aggrieved states, under the federal common law of nuisance, for the pollution of interstate waters by citizens of another state. The State of Illinois sued four Wisconsin cities and two sewerage commissions for their pollution of Lake Michigan. Illinois sought to invoke the original jurisdiction of the United States Supreme Court on the basis that the action was one in which a state was a party. The court, in a unanimous decision, held that when interstate water is polluted an action arises under the common law of the United States, and the parties have federal question jurisdiction in the federal district courts. This decision seemingly overruled an earlier Supreme Court decision. This author of this article asserts that no longer will states with high quality water standards be without a remedy against citizens of neighboring states with lesser standards who pollute common waters and that theoretically the decision allows an action in federal district court by a private individual for abatement of a nuisance to his land arising from the pollution of interstate waters. (Sears-Florida)
W74-03382

INTERNATIONAL ENVIRONMENTAL BIBLIOGRAPHIES, SERIES I: LEGISLATIVE AND REGULATORY REPORTS. Environmental Protection Agency, Washington, D.C. Office of International Activities.

April 1973. 129 p.

Descriptors: \*Legal aspects, \*International law, Laws, \*Organizations, \*Bibliographies, \*Foreign countries, Europe, \*Legislation, \*Regulation, Water quality.

Identifiers: National Environmental Protection

Agency.

The U.S. Environmental Protection Agency (EPA) with the cooperation of other national environmental organizations, is developing a collection of documents related to environmental laws and regulations throughout the world. This report is a preliminary bibliography of document received by the EPA through document exchanges with other countries. Additional contributions will be included in the final version. This bibliography contains summaries of the various laws, stating the language in which it is written, the date of the publication and its length. The summaries are orpublication and its length. The summaries are or-ganized by country. The countries covered in this bibliography include: Belgium, Canada, Czechoslovakia, Eastern Europe (Regional), France, Federal Republic of Germany, Great Britain, Italy, Japan, Netherlands, New Zealand, Norway, South Africa, Spain, Sweden, Switzer-land, United States, Union of Soviet Socialist Republic, Western Europe (Regional) and Yu-goslavia. (Sears-Florida) W74-03383

THE SUBSTANTIVE RIGHT TO ENVIRON-MENTAL QUALITY UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT. For primary bibliographic entry see Field 06E. W74-03384

STATEMENT FOR PUBLIC MEETINGS OF THE DEPARTMENT OF ARMY CORPS OF EN-GINEERS CONCERNING THE REFORMULA-TION OF THE SIXES BRIDGE, DAM, AND LAKE PROJECT MARYLAND, AND THE VERONA DAM AND LAKE PROJECT, VIR-

GINIA, Interstate Commission on the Potomac River Basin, Washington, D.C.

P. Eastman April 25-27, 1973, 5 p.

Descriptors: \*Interstate commissions, \*River Basins Commissions, \*Interstate Compacts, \*Water pollution control, \*Water supply, Impoundments, Maryland, Pennsylvania, \*West Virginia, District of Colombia, \*Potomac River.

The Interstate Commission on the Potomac River Basin (ICPRB) was established in 1940 by a com pact among the states of Maryland, Pennsylvania, Virginia, and West Virginia and the District of Columbia for the purpose of promoting and coor-dinating water pollution control in the Potomac Basin. A 1971 resolution of the ICPRB recognized the need for additional impoundment projects to meet water supply requirements and the possible use of the Potomac Estuary for said purpose. In March of 1973 the ICPRB identified the Verona and Sixes Bridge projects as the most viable alter-natives to provide the needed water supply. Related developments supporting the two impound-ments include recommendations of the Washington Area Interstate Water Resources Program, passage of the Federal Water Pollution Control Act Amendments of 1972 and the Congressional action on the 1972 Rivers and Harbors and Flood Control Legislation. The report also considers a comprehensive set of alternatives for water supply for the Washington, D.C. area. (Sears-Florida) W74-03386

WATER POLLUTION CONTROL HANDBOOK--A CITIZENS GUIDE TO THE FEDERAL WATER POLLUTION CONTROL ACT AMEND-MENTS OF 1972--VOLUME II, Natural Resources Defense Council, Washington,

D.C. Project on Clean Water.

July 1973. 71 p, 1 tab, 3 append.

Descriptors: \*Water pollution controk, \*Permits, \*Effluents, Regulation, United States, Environ-mental protection, Federal Water Pollution Control Act, Legislation, Administrative agencies, Water quality control. Water resources.

This volume of the water pollution control handbook examines certain aspects of the National Pol-lutant Discharge Elimination System (NPDES). The Federal Water Pollution Control Act Amendments of 1972 provide that the Environmental Protection Agency (EPA) shall issue all NPDES permits unless a state qualifies to run the program. Each state that desires control of the permit program must take an application to EPA, fulfilling certain requirements of the act and guidelines is-sued by EPA. During the period in which the state does not qualify to run the NPDES, EPA has the authority to issue permits to dischargers. Because of the many technical questions raised in the issuance of individual permits, the project on clean water has produced this volume to examine in detail the process with emphasis on EPA procedures. The volume focuses on analysis of guidelines, sources for the effluent limitations and reviews pertinent technical issues and it outling avenues of redress in protesting the issuance of an individual permit. (Daniels-Florida)

A BILL TO AMEND THE FISH AND WILDLIFE COORDINATION ACT BY PROVIDING FOR REGULATION OF DUMPING IN UNITED STATES WATERS.

For primary bibliographic entry see Field 06E. W74-03390

CONCURRENT RESOLUTION EXPRESSING THE SENSE OF THE CONGRESS WITH RESPECT TO WATER POLLUTION. For primary bibliographic entry see Field 06E. W74-03393

A BILL TO IMPLEMENT THE INTERNA-TIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE AND THE IN-TERNATIONAL CONVENTION ON THE ESTABLISHMENT OF AN INTERNATIONAL FUND FOR COMPENSATION FOR OIL POLLU-TION DAMAGE.
For primary bibliographic entry see Field 06E.

W74-03395

A BILL AUTHORIZING THE CONSTRUCTION, REPAIR, AND PRESERVATION OF CERTAIN PUBLIC WORKS ON RIVERS AND HARBORS FOR NAVIGATION, FLOOD CONTROL, AND For primary bibliographic entry see Field 06E. W74-03396

BANKLICK CREEK WATERSHED (FINAL EN-VIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 04D. W74-03398

AN ACT TO REGULATE THE TRANSPORTA-TION FOR DUMPING, AND THE DUMPING OF MATERIAL INTO OCEAN WATER, AND FOR

For primary bibliographic entry see Field 06E. W74-03399

UNITED STATES V. PENNSYLVANIA INDUS-TRIAL CHEMICAL CORP. CORPORATION WAS CONVICTED OF DISCHARGING REFUSE INTO NAVIGABLE WATERS IN VIOLATION OF RIVERS AND HARBORS ACT OF 1899, AND

IT APPEALED).
For primary bibliographic entry see Field 06E.
W74-03407

CENTRAL BUCKS JOINT SCHOOL BUILDING AUTHORITY V. RAWLS (ACTION BY LAN-DOWNER TO RECOVER COMPENSATION FOR ALLEGED DE FACTO TAKING OF PRO-PERTY).

For primary bibliographic entry see Field 06G. W74-03409

SEWERAGE DISTRICTS AND SEWERAGE DIS-TRICT BOARDS. For primary bibliographic entry see Field 06E. W74-03411

STATE ASSISTANCE FOR LOCAL GOVERN-MENT.

ary bibliographic entry see Field 06E. For primary W74-03412

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

# Group 5G-Water Quality Control

SOAP AND DETERGENT ASSOCIATION V. CITY OF CHICAGO (DECLARATORY ACTION TO SET ASIDE CITY ORDINANCE PROHIBITING SALE OF PHOSPHATE DETERGENTS). For primary bibliographic entry see Field 06E. W74-03414

U.S. V. JOSEPH G. MORETTI, INC. (LAND FILLS DEEMED 'STRUCTURES' UNDER RIVERS AND HARBORS ACT OF 1899).
For primary bibliographic entry see Field 06E. W74-03416

KINGS COUNTY ECONOMIC COMMUNITY DEVELOPMENT ASSOCIATION V. HARDIN (PAYMENT OF FARM SUBSIDIES DO NOT REQUIRE NEPA APPROVAL).
For primary bibliographic entry see Field 06E.
W74-03417.

THE NATION'S ESTUARIES: SAN FRANCISCO BAY AND DELTA, CALIFORNIA.

Hearing-Subcomm on Government Operations, House of Representatives, 91st Cong, 1st Sess, May 15, 1969. 251 p, 6 map, 4 chart, 2 append.

Descriptors: \*California, \*Bays, \*Landfills, \*Water pollution, \*Estuarine environment, Environmental effects, Pollutants, Fishkill, Aquatic habitats, Governmental interrelations, Federal government, Ecology, Water resources, Effluents, Balances and nature, Bodies of water.

This subcommittee hearing concerned water pollution and landfill problems in San Francisco Bay and was the first phase of a study of the destruction of the Nation's estuaries and waterways by pollution and excessive filling. San Francisco Bay is one of the world's great natural harbors and it is vital to the economy and ecology of the entire San Francisco area. The bay area now faces a serious environmental crisis and the problems will worsen as the area's population increases. Diking and filling of the shoreline have already reduced the bay's water area to 60% of what it was 100 years ago. The subcommittee received detailed testimony about a wide range of particular problems which the land fill and pollution have precipitated, including the detrimental effects on the population of fish, oysters, crabs, and shrimp. The general concensus of those who addressed the subcommittee was that unless drastic measures are taken in the near future, the bay will soon be a sewer-like river, devoid of aquatic life. (McKnight-Florida)

CITY OF CHAMPAIGN V. ENVIRONMENTAL PROTECTION AGENCY (ADMINISTRATIVE PROCEEDING FOR ALLEGED POLLUTION AGAINST CITY, UNIVERSITY BOARD OF TRUSTEES AND OTHERS). For primary bibliographic entry see Field 06E. W74-03421

CHARLES V. DIAMOND (EXTENT TO WHICH POLICE POWERS MAY BE USED TO DISAD-VANTAGE INTERESTS IN PRIVATE PROPER-TY).

For primary bibliographic entry see Field 06E. W74-03422

CAMPAIGN CLEAN WATER, INC. V. RUCKELSHAUS, (ACTION BROUGHT AGAINST ADMINISTRATOR OF ENVIRONMENTAL PROTECTION AGENCY CHALLENGING IMPOUNDMENT WITH RESPECT TO FUNDS AUTHORIZED TO BE APPROPRIATED BY CONGRESS).
For primary bibliographic entry see Field 06E. W74-03424

CAPE HENRY BIRD CLUB V. LAIRD (ACTION FOR INJUNCTIVE AND DECLARATORY RE-LIEF, ON ENVIRONMENTAL GROUNDS, AGAINST FEDERAL DAM PROJECT). For primary bibliographic entry see Field 06E. W74-03425

U.S. V. REYNOLDS METALS COMPANY (CORPORATE IMMUNITY FOR POLLUTION UNDER RIVERS AND HARBORS ACT OF 1899), For primary bibliographic entry see Field 06E. W74-03426

A PLANNING MODEL FOR A WATER QUALI-TY MANAGEMENT AGENCY, SDL Inst., Toronto (Ontario).

SDL Inst., Toronto (O. A. C. Taylor.

Management Science, Vol 20, No 4, p 675-685, December, Part II. 1973, 4 tab. 9 ref.

Descriptors: \*Water quality control, \*Waste water (Pollution), \*River basins, \*Management, \*Planning, \*Standards, Bids, Optimum development plans, Mathematical models, Systems analy-

Identifiers: \*Rent allotment, Agencies, Ottawa River (Canada).

The Canada Water Act provides for establishment of regional management agencies in areas designated as water quality management areas. The agencies establish water quality standards within their area and design a control program to meet these standards efficiently and economically. Described is a model for planning an effective water quality program within a river basin. The waste abatement control employed is called the rent allotment control, whose merit is that its implementation provides a solution to the information problem of efficient waste abatement. Control is implemented through a bargaining process between the agency and the waste dischargers, characterized as an n-person prisoner's dilemma. The game provides information about individual waste abatement costs, and terminates in a set of agreements on rents and allotments which depend upon the bidding strategies adopted by each player. Optimal bidding strategies are examined. Presented as an example is the simulation of the poperation of the rent allocation scheme using data from the Ottawa River in eastern Ontario. The rent allotment game encourages dischargers to estimate their waste abatement activity in face of a declared effluent charge and to declare the allotment this would require. (Bell-Cornell)

ANALYZING THE ENVIRONMENTAL IM-PACTS OF WATER PROJECTS. Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 06G. W74-03472

THE RESOLUTION OF UNCERTAINTY, George Washington Univ., Washington, D.C. National Law Center. H. P. Green. Natural Resources Journal, Vol 12, No 2, p 182-

Natural Resources Journal, Vol 12, No 2, p 182 186, 1972.

Descriptors: \*Decision making, \*Social participation, Pollutant identification, Technology, \*Risks, DDT, Air pollution, Water pollution, Environmental effects, \*Political aspects, Costs, Benefits. Identifiers: Automobile, Internal combustion engine.

The basic difficulty in dealing with pollutants is inability to predict their adverse consequences. Determination of harm arising from such activities is typically made well after the technology, production or consumption activity has become entrenched. This leads to a number of political difficulties as groups affected by reversals attempt to protect their interest. The essential need is to develop political institutions which give an equal forum to potentially adverse environmental effects. Within this forum, the existence of unresolved uncertainty should be regarded as a substantial environmental cost of the technology in determining whether the technology should be implemented. It is apparent that laws limiting introduction of technology until uncertainty is resolved may result in no new technology being introduced. While this extreme point is not advocated, a strong case is made that the implications of uncertainty be clearly articulated so that the public can decide whether the potential benefits and costs justify the introduction of a new technology. (Schroeder-Wisconsin) W74-03479

A GUIDE TO DECISION MAKING FOR WATER RESOURCES MANAGEMENT IN THE SAN ANTONIO REGION.

San Antonio River Authority, Tex. For primary bibliographic entry see Field 06B. W74-03484

RESOURCE ALLOCATION, INFORMATION COST AND THE FORM OF GOVERNMENT INTERVENTION.
California Inst. of Tech. Pasadena. Environmenting.

California Inst. of Tech., Pasadena. Environmental Quality Lab.

J. E. Krier, and W. D. Montgomery. Natural Resources Journal, Vol 13, No 1, p 89-105, 1973, 24 ref.

Descriptors: \*Regulation, Standards, Pollution taxes (Charges), Economic efficiency, Decision making, \*Marginal costs, Pricing, \*Pollution abatement, Welfare (Economics), \*Resources allocation.

Identifiers: Externalities, \*Government intervention. Price system.

Demsetz's thesis suggests that property rights developed when gains from its development ex-ceeded its costs. These same forces which created a private property system also determine the form of governmental intervention when the property system fails. A classic example of such a failure is pollution. High transaction costs have prevented the private market from internalizing pollution costs. Government intervention has been limited to the setting of standards which have minimal information costs. Standards do not yield an efficient solution because producer's varying mar-ginal costs would be monumental. The price system could bring about marginal cost pricing at a significantly lower cost, although at greater infor-mation cost than for existing standards. At present the marginal gains from greater efficiency in converting to the price system are less than its addi-tional information costs even though the benefit from invoking a general standard are justified. As resources like clean air and water become scarcer and hence more valuable, marginal cost pricing through the price system will become justified. An examination of governmental statements shows that regulation through the use of the price system rather than standards has gained support in recent years. (Schroeder-Wisconsin) W74-03485

ANALYSIS OF COSTS OF POLLUTION CONTROL.

Organization for Economic Co-Operation and Development, Paris (France).

1973.9 p.

Descriptors: "Cost analysis, "Economic impact, "Pollution abatement, Industries, Foreign trade, Resource allocation, Estimated costs, Water pollution control. Identifiers: Pollution control costs, Macroeconomics, "OECD.

Pollution control will probably increase in all of the major industrial Member countries of the Or-ganization for Economic Co-operation and Development. This will mitigate the effects of pollution control measures on international trade and balance of payments. Differences in the magnitude and timing of pollution control costs may have some effects on international trade. On the basis of present estimates pollution control costs will be considerably lower than some other welfare oriented expenditures and defense spending. This gives some indication of the impact of pollution control costs on a nation's ability to satisfy other needs of its society on the macroeconomic level. It should be noted that present estimates do not take into account resource saving attributable to pollution control. Pollution control measures will lead to a shift in the use of economic resources but this shift in most cases will probably not be greater than many other changes experienced in Member countries. Pollution control in some individual plants and parts of an industry may, in some cases, affect their competitive position, both in international and internal trade. Data for Member countries, where costs are presently being evaluated in depth, are not included in this study. (Slattery-W74-03486

# THE POLLUTION CONTENT OF AMERICAN

TRADE, New York Univ., N.Y.

ments. Exports. Imports.

I. Walter.

Western Economic Journal, Vol 11, No 1, p 61-70, 1973. 2 tab. 28 ref.

Descriptors: \*Foreign trade, \*Pollution abate-ment, \*Costs, Environmental effects, Environmental control, Competitive prices, Industries, Agriculture, Transportation, Utilities. Identifiers: \*International trade, Balance of pay-

This study attempts to determine whether environmental control charges incurred by industry form an essentially 'trade-neutral' pattern, or whether they are fundamentally export-biased or importbiased. If U.S. exports are inherently more pollution-intensive than imports, then whatever pattern of environmental policies eventually emerges among the major trading nations will impact disproportionately on U.S. performance in the international market. Environmental control costs for 18 manufacturing industries, aggregate mining, transportation, utilities, commercial services, communication, and agriculture are derived from current research and development expenditures, depreciation charges on in-place pollution control equipment, the capital cost of in-place pollution control equipment, and current operating costs associated with environmental management. The estimated environmental control costs per dollar of gross industry sales is generated from these figures. These industry-based estimates were then translated into product-based cost estimates utilizing 83 goods and services categories in order to apply them in an international trade context. Preliminary findings indicate that for the United States such a bias might be adverse, but only marginally so. The impact on the direction of trade and on the international competitiveness of the individual economic sectors could be substantial. (Slattery-Wisconsin) W74-03490

# ECONOMIC GROWTH AND ENVIRONMEN-TAL DECAY: THE SOLUTION BECOMES THE

PROBLEM,
Washington State Univ., Pullman. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.

POLLUTION: ECONOMY AND ENVIRON-MENT. Kent Univ., Canterbury (England). Dept. of Economics. For primary bibliographic entry see Field 06B. W74-03493

CONSTRUCTING NONLINEAR DYNAMIC MODELS FOR SOCIO-ENVIRONMENTAL DECISIONMAKING: A METHODOLOGY, California Univ., Davis. Inst. of Governmental Affairs. For primary bibliographic entry see Field 06A. W74-03501

USEFUL WATERS FOR CALIFORNIA. California State Water Resources Control Board,

Final Report, 1967. 20 fig.

Descriptors: \*Water pollution control, \*Water quality, \*California, \*Administration, Legislation, Hydrology, Water resources development, Waste treatment, Government finance, Monitoring.

The work of the State and Regional Water Quality Control Boards since the enactment of the Dickey Water Pollution Act of 1949 to June 30, 1967 is exd. Original concepts, legislative history ar each phase of the water pollution and water quali-ty control effort are presented. Water programs in all areas of the State are covered including programs in the North Coastal, San Francisco Bay, Central Coastal, Los Angeles, Central Valley, Lahontan, Colorado River Basin, Santa Ana, and San Diego regions. Community waste treatment facilities, monitoring programs, financial assistance programs, reports of special investiga-tions, and state board actions are among the Board's activities presented. In 1967 the California Legislature enacted important changes in the California Water Code, the Principal change being the consolidation of the State Water Rights Board and the State Water Control Board into a new State Water Resources Control Board. (Slattery-

# MERCURY POLLUTION AND ENFORCEMENT

MERCURY POLLUTION AND ENFORCEMENT OF THE REFUSE ACT OF 1899 (PART 2). For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$0.75. Hearings -- Subcomm of the Comm on Government Operations, House of Representatives, 92nd Cong. 1st Sess, October 21 and November 5, 1971. 158 p., 2 tab.

Descriptors: \*Mercury, \*Channels, dumps, Wastes, Toxicity, Permits, Pollution, Water pollution sources, Governmental interrela-tions, Legal aspects, United States, Legislation. Identifiers: \*Refuse Act of 1899, Congressional hearings.

The House Conservation and Natural Resources Subcommittee conducted hearings on enforce-ment of the 1899 Refuse Act by the Corps of Engineers and other agencies on actions taken or aned by the Environmental Protection Agency and the Justice Department concerning the m ry polluters. The subcommittee also wanted to learn why Administration officials were negotiate ing an agreement to let Armco Steel dump its toxic wastes into the Houston ship channel, in light of a recent Federal district court order prohibiting such dumping. Statements are included from representatives of the Corps of Engineers, Department of Justice and Environmental Protection Agency. Copies of correspondence between the subcommittee and all three entities; copies of newspaper articles; and an interest of the system W74-03558

DELAYED RECOVERY OF A MESOTROPHIC LAKE AFTER NUTRIENT DIVERSION, Partalla Decific Northwest Labs.. Richland, Battelle-Pacific Northwest Labs., Wash For primary bibliographic entry see Field 05C. W74-03560

MASTER PLAN FOR WATER SUPPLY, BUCKS COUNTY, PENNSYLVANIA, 1970. Justin and Courtney, Philadelphia, Pa For primary bibliographic entry see Field 03D. W74-03629

EMPHASIZING QUALITY CONTROL, Seattle Dept. of Water, Wash. For primary bibliographic entry see Field 05F. W74-03636

# CLEANUP OF POLLUTED RHINE RIVER WILL COST WESTERN EUROPE BILLIONS.

Engineering News-Record, Vol 191, No 14, p 40-41, October 4, 1973, 1 fig. 5 photos.

Descriptors: \*Water quality control, \*Thermal pollution, \*Pollution abatement, \*Chlorides, Water temperature, Europe, Powerplants. Identifiers: \*International agreements, Groundwater depletion, \*Rhine River.

Despite expenditures of \$2.5 billion for primary and secondary treatment of municipal wastes and \$187 million for industrial waste treatment between 1966 and 1971, the Rhine River grows more polluted because effluent dumped into the river increases. The single largest source of pollution are potash mines in Alsace which dump 270 lbs. of chlorides per second into the river. Approxinto the river. Approximately 20 million Germans and 7 million Dutch rely on the Rhine for household water. Since groundwater supplies are low and becoming exhausted, dependence on the Rhine will austed, dependence on the Rhine will grow. Thermal pollution from future powerplants has been nipped by an international agreement requiring cooling towers for future power plants so that the river is at no point heated 5F above its normal tem-perature and never over 84F. Without the ban on thermal pollution, it is estimated that river tem-perature would rise to 95F by 1985. The West German Interior Ministry is designing a bill to charge a tax for municipalities and industries which dump untreated wastes into the river. The Dutch passed a similar law for industries in 1971. International agreements have resulted in a Frence Commitment agreements have resulted in a Frence Commitment to cut chloride dumping in half and a sharing of the \$200 million costs to build new disposal facilities. The German water treatment plant on the Emscher River 10 miles from the Netherlands is cited as an example of international cooperation. Expendi-tures to date must be doubled or tripled in order to achieve 100% secondary treatment for municipal wastes by 1980. (Stein - North Carolina) W74-03637

#### RESPONSIBILITIES OF LOCAL AUTHORITIES FOR WATER POLLUTION CONTROL.

British Water Supply, No 4, p 16-23, April, 1973.

Descriptors: \*Local governments, \*Europe, \*Water pollution control, Governmental interrelations, Locating, Planning. Identifiers: Siting, Police measures.

Replies to a survey administered by the Council of Europe's Committee on Co-operation in Municipal and Regional Matters on responsibilities of local authorities in Europe for prevention of water pol-lution are analyzed. Recently there has been a trend toward comprehensive national legislation to control pollution. With the exception of countries

# Field 05-WATER QUALITY MANAGEMENT AND PROTECTION

## Group 5G-Water Quality Control

with federal structures, legislation for water pollution control is normally prepared by central governments and delegated to relevant localities to implement. Two of the three general responsibilities of local authorities for water pollution control are considered here: (1) planning to regulate location of activities likely to affect water quality and (2) police measures to prohibit discharge and drainage likely to pollute watercourses and groundwater. Local planning controls generally include ability to control siting, grant building permits, and ability to plot sewerage lines and facilities. Police measures are usually exercised within narrowly prescribed limits. Measures are both preventive and punitive. In some countries, local authorities may impose stricter measures than those which have been nationally prescribed. (Stein - North Carolina) W74-03639

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION. VOLUME I: METHODOLOGY ANALYSIS OF WATER RESOURCE AREAS.

Alamo Area Council of Governments. San Antonia, Tex.

For primary bibliographic entry see Field 06B. W74-03642

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME III: SHORT RANGE PROGRAM 1970-

Alamo Area Council of Governments, San Antonio Tex.

For primary bibliographic entry see Field 06B. W74-03644

WATER AND SEWER STUDY: PART 2 PLANS AND PROGRAMS, SUMMARY REPORT BUN-COMBE COUNTY, NORTH CAROLINA. Register and Cummings, Asheville, N.C.

Summary Report prepared for Metropolitan Planning Board, Asheville, N.C. (June, 1971). 4 p, 2 tab, 2 maps.

Descriptors: \*Planning, \*Water supply, \*Sewerage, Urbanization, Leakage, Regional development, Coordination, Water sources, Water \*North Carolina

Identifiers: \*Asheville (N.C), Joint facilities, Utility extensions, Buncombe County (N.C.).

Water and sewer systems can serve as a framework for urban development, but they often just follow random urban developments and result in inefficient systems and poor service. Thus, it is important to engage in metropolitan and regional planning to determine the location of major water transmission and sewer lines, treatment plants and wastewater outfalls, and water supply sources, and to plan joint facilities to improve efficiency, management, and service. The short range water plan for the Asheville metropolitan area focuses on deficiencies of the existing systems and programs to correct them such as controlling leakages, extending new water lines, covering small reservoirs, and monitoring treatment plants. Long range water plans and programs call for a single county-wide system based on the existing Asheville system. Short range sewerage plans focus on correcting leakage problems and extending new interceptor sewers. Long range plans emphasize the need for coordinated management of all the sewerage systems in the county under a single public authority, using the Metropolitan Sewerage District as a foundation organization. Elfers-North Carolina) W74-03645 WATER FACILITIES FOR EAST ORANGE AREA FOR CITY OF ORANGE AND EAST ORANGE COUNTY WATER DISTRICT. Boyle Engineering, Santa Ana, Calif. For primary bibliographic entry see Field 03D.

COMPREHENSIVE WATER SYSTEMS NEEDS PLAN, 1970-2000, ALLEGHENY COUNTY, PENNSYLVANIA.

Green Engineering Co., Sewickley, Pa.
For primary bibliographic entry see Field 03D. W74-03650

CONTROL OF AQUATIC PLANT LIFE, Pennwalt Corp., Philadelphia, Pa. (Assignee) For primary bibliographic entry see Field 04A. W74-03653

INSTALLATION OF UNDERWATER POLLU-TION APPARATUS, Esso Production Research Co., Houston, Tex. (as-

signee). T. W. Childers.

U.S. Patent No. 3,770,052, 5 p, 9 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 916, No 1, p 115, November 6, 1973.

Descriptors: \*Patents, \*Oil pollution, \*Pollution abatement, Equipment, Underwater, \*Oil wells, \*Wells, Water pollution control, Water quality control, Leakage, Seepage control. Identifiers: Underwater wells.

A method of installing and forming an inverted drip pan roof over both an underwater wellhead and a production manifold for such a wellhead is described. According to the method, a manifold drip pan is arranged over a production manifold. A wellhead drip pan is then run down to the underwater location in a tilted attitude for placement over the wellhead, the leading end of the tilted drip pan facing the direction of the production manifold. The tilted attitude reduces the projec-tion of the wellhead drip pan. The descent of the tilted wellhead drip pan is stopped below and behind the near edge of the manifold drip pan, and the wellhead drip pan is then pivoted. This placement establishes an inverted drip pan roof in which at least the wellhead drip pan portion slopes upwardly from a low point at the trailing end of the wellhead drip pan. It thereby establishes a continuous upwardly inclining passageway over the well-head and the production manifold along which fu-gitive oil fluids from the wellhead or the production manifold, or both, will be directed by gravity flow to an uppermost portion of the manifold cover for confinement. (Sinha - OEIS) W74-03661

CONTROLLING ALGAE WITH 5- (5 BARBITU-RILIDENE)-RHODANINE, Gates Rubber Co., Denver, Colo. (assignee).

For primary bibliographic entry see Field 04A. W74-03665

SORBENT BELT, Shell Oil Co., New York, (assignee).

R. R. Ayers. U. S. Patent No 3,770,626, 2 p, 1 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 916, No 1, p 251, November 6, 1973.

Descriptors: \*Patents, Oil spills, Equipment, \*Oil pollution, \*Pollution abatement, Water pollution control, Water quality control, Separation techniques.
Identifiers: \*Sorbent belts.

Free flow paths are used to divert pollutant flow into greater contact with the sorbent body being employed. The sorbent belts are claimed to be superior to others since (1) the configuration of the belt provides free flow paths which pull the polu-tant (oil) to the belt thereby reducing the area to be covered by the belt, (2) the free flow paths propel the pollutant into more intimate contact with the sorbent so that the pollutant is more efficiently removed, and (3) the pollutant is imbibed in a shorter residence time because the oil reaches the interior of the belt by free flow, in which surface forces do not predominate, to increase the sorp-tion rate. (Sinha - OEIS) W74-03672

PUBLIC WORKS FOR WATER AND POWER DEVELOPMENT AND ATOMIC ENERGY COMMISSION APPROPRIATION BILL, 1974, PARTS 1 AND 2.

For primary bibliographic entry see Field 06E. W74-03710

EPA POLLUTION REGULATIONS AND FUEL SHORTAGE: THE IMPACT ON

Hearing--Subcom. on Urban Mass Transportation-Comm. on Banking and Currency—United States House of Representatives, 93d Cong., 1st sess., July 26, 30, 31, 1973. 683 p, 22 fig, 5 map, 21 tab, 1 ref. 1 append.

Descriptors: \*Energy budget, \*Highways, \*Transportation, Chemical wastes, Oily wastes, Water pollution sources, Fuels, Gasoline, Water pollu-tion effects, Social aspects, Legal aspects, Ad-ministrative agencies, Federal government, Legislation.

\*Congressional hearings, transit, Energy conservation, Energy crisis.

These hearings concerned the Environmental Protection Agency pollution regulations and their impact on mass transit. Witnesses included many federal, state, transportation and energy personnel. Also included were political interest groups and university research centers. These witnesses discussed and examined the energy crisis, and the role mass transit can play in alleviating that crisis. The Environmental Protection Agency representatives discussed the relation between air pollution and the reliance on the automobile, and the need for increased reliance on mass transit in the future. hether EPA standards are being relaxed to cope with the fuel crisis was also a topic of deep con-cern. Methods of conserving fuel other than mass transit were also discussed. Testimony was taken as to the effect of EPA regulations on transit system development. Air pollution, basically as a result of the automobile, is the chief environmental problem. However, due to the necessity for increased energy supplies, water pollution may increase in the future. (Sperling-Florida) W74-03711

RECYCLING WASTES FOR MARICULTURE. H. V. R. Palmer, Jr. Sea Frontiers, Vol 19, p 368-369, November-December 1973. 4 photo.

Descriptors: \*Algae, \*Sewage, \*Sewage disposal, \*Recycling, \*Oysters, Water pollution control, Nutrients, Nitrates, Phosphates, Ammonia, Wastes, Organic wastes, Tertiary treatment, Viruses, Water pollution, Water pollution sources, Sea water, Effluents, Waste water disposal, Reclaimed water. Identifiers: \*Mariculture, Seaweed.

The Woods Hole Oceanographic Institution in Massachusetts is attempting to utilize the beneficial, nontoxic materials contained in sewage. These nontoxic constituents consist, among other things, of phosphates, nitrates and ammonia, and are essential to the growth of plant life in the oceans. By introducing secondarily treated sewage into normal seawater, algae consume the nutrients from the effluent, providing in effect, tertiary treatment of the sewage. Next, the cleansed water containing the algae passes into an open tank with racks of oysters, which feed on the algae. The type of system described could in the future serve a coastal municipality as a combined sewage treat-ment/mariculture facility. A problem being at-tacked at the facility is that of wastes excreted by the oysters, necessitating the introduction of seaweed into the oyster farm to consume the dissolved wastes. Solid wastes can be consumed by certain bottom-dwelling invertebrates, such as marine worms and crustaceans. Some process however must be found to cleanse viruses from the effluent before it reaches the oyster farm, meat. (Ritchie-Florida)
W74-03714

CRIMINAL OFFENSES--POLLUTION). For primary bibliographic entry see Field 06E. W74-03722

ZONING-SUBDIVISION OF LAND. For primary bibliographic entry see Field 06E. W74-03723

INTERTIDAL SALT MARSHES--PENALTY. For primary bibliographic entry see Field 06E. W74-03727

ELIMINATION OF MOSOUITO-BREEDING PLACES. For primary bibliographic entry see Field 06E. W74-03730

WATER POLLUTION CONTROL. For primary bibliographic entry see Field 06E. W74-03733

MUNICIPALITIES-LAKE AUTHORITIES. For primary bibliographic entry see Field 06E. W74-03734

OHIO RIVER VALLEY WATER SANITATION COMMISSION.
For primary bibliographic entry see Field 06E.
W74-03736

TUNING DOWN THE GNP, Reilly, Like and Schneider, Babylon, N.Y. For primary bibliographic entry see Field 06G. W74-03744

POLLUTION CONTROL AND THE BEHAVIOR OF THE FIRM--A TECHNICAL NOTE. Colorado State Univ., Fort Collins. L-S. Fan, and B. R. Froehlich. The Engineering Economist, Vol 17, No 4, p 261-267, 1972. 3 ref.

Descriptors: \*Pollution taxes (Charges), \*Economic efficiency, \*Pollution abatement, \*Water quality standards. Identifiers: Effluent market, \*Concave programming, Multiproduct firms.

The effects of pollution standards and a waste surcharge on a multiproduct firm's profit max-imization decision are examined in order to illustrate the limited usefulness of the classical firstorder profit maximization conditions. The firm considered is a supplier of abated effluents to an existing market. Total revenue to the firm is the sum of the revenues from products plus revenue from the sale of recovered effluent. Total cost includes production costs plus abatement costs and effluent surcharges. It is assumed that firms attempt to satisfy only the minimum pollution stan-dard, thereby requiring all the pollution con-straints to be met as strict equalities. This may be consistent with a firm's short run decisions. Firstorder conditions are generated for the competitive and noncompetitive case. For the first, profits are maximized when the market price of a particular product equals the marginal costs plus the sum of the net marginal costs of abatement and disposal. In the second case, maximization occurs by equating marginal revenue to the costs above. Only in the case of no effluent markets and constraints does the classical profit maximization point lead to an optimal solution. (Schroeder-Wisconsin) W74-03749

# 06. WATER RESOURCES PLANNING

# 6A. Techniques of Planning

SIMULATION OF A PETROLEUM REFINERY WASTE TREATMENT PROCESS, McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05D.
W74-03467

A MATHEMATICAL MODEL FOR OPTIMUM DESIGN AND CONTROL OF METROPOLITAN WASTEWATER MANAGEMENT SYSTEMS, Battelle-Pacific Northwest Labs., Richland, Wash

For primary bibliographic entry see Field 05D. W74-03468

A PLANNING MODEL FOR A WATER QUALI-TY MANAGEMENT AGENCY, SDL Inst., Toronto (Ontario). For primary bibliographic entry see Field 05G. W74-03469

A DYNAMIC PROGRAMMING-SIMULATION STRATEGY FOR THE CAPACITY EXPANSION OF HYDROELECTRIC POWER SYSTEMS, Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 08C. W74-03470

ANALIZING THE ENVIRONMENTAL IN PACTS OF WATER PROJECTS. Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 06G. W74-03472 ANALYZING THE ENVIRONMENTAL IM-

CONSTRUCTING NONLINEAR DYNAMIC MODELS FOR SOCIO-ENVIRONMENTAL DECISIONMAKING: A METHODOLOGY, California Univ., Davis. Inst. of Governmental Af-

W. Arnold, III, J. W. Young, and J. W. Brewer Environmental Quality Series No 11, October 1972. 138 p., 45 fig, 15 tab, 27 ref.

Descriptors: "Methodology, "Systems analysis, \*Environmental effects, "Social aspects, \*Economics, Model studies, Decision making, Data collections, Analytical techniques, Simulation analysis, Dynamic programming, California. Identifiers: \*Lake Tahoe Basin (Calif-Nevada),
\*Quasilinearization, \*Socioeconomic models, Forrester's formalism, Multipliers.

A methodology for the development of socioeconomic system submodels which could be integrated into environmental impact studies is presented. The so-called method of quasilinearization is incorporated into the model building procedure in order to obtain values of unknown and important parameters. As an exam-ple illustrating application of techniques proposed in the model construction methodology, the socioeconomic system of the Lake Tahoe Basin is modeled and unknown parameters in the model identified. It is concluded that social systems experts with little or no mathematical background can be included in the model building process, eter identification schemes can be employed to determine selected model parameters, reevaluation of the model after data collection is critical, and methods used for interpretation of some data is a major weakness in the present versome data is a major weathers in the present ver-sion of the model. Some topics suggested for fu-ture study, based on this research, include integra-tion of the socioeconomic model with environmen-tal submodels to determine the impact of urbanization on the environment, improvement of the quasilinearization scheme, and the development of numerical techniques to reduce long computer run times for systems of large appended state vectors using quasilinearization. (Slattery-Wisconsin) W74-03501

THE OPTIMAL TIME TO START THE OPERA-TION OF A DESALTING PLANT IN ISRAEL, Tel-Aviv Univ. (Israel). Dept. of Economics. For primary bibliographic entry see Field 03A.

### 6B. Evaluation Process

SOCIAL COSTS AND BENEFITS OF WATER RESOURCE CONSTRUCTION. Kentucky Water Resources Inst., Lexington. R. J. Burdge, and K. S. Johnson. Available from the National Technical Informa-tion Service as PB-226 815; \$3.00 in paper copy, \$1.45 in microfiche. Research Report No 64, 1973. 36 p, 23 tab, 13 ref. OWRR A-043-KY (1). 14-31-0001-3517 14-31-0001-3817

Descriptors: \*Social adjustment, \*Social impact, \*Migration, Social change, \*Social values, Social aspects, Project feasibility, Cost-Benefit analysis, Intangible costs, Land appraisals, \*Kentucky, Planning, Reservoir construction, \*Pre-impound-

Identifiers: Forced relocation, Social costs, Social benefits

The process of relocating individuals and families who must move due to reservoir construction in Kentucky is analyzed and described utilizing data collected in previous research. These data come from four separate studies: a study of community attitudes toward reservoir construction (Johnson County where the Paintsville reservoir is to be constructed), interviews with people who are slated for relocation when the Taylorsville reservoir is constructed, and two sets of interviews with people who have already been relocated due to reservoir construction (Cave Run and Carr Fork). Psychological, social, economic and materi-al costs and benefits associated with forced relocation are presented, and the role of the relocation agency (The Army Corps of Engineers) in the process is described. Generally, the younger, more affluent and educated migrants fare better in the relocation process than older, poorer and less-educated migrants. Particular attention is paid to those people who found relocation psychologically and economically costly because these are unan-ticipated and usually unrecorded real costs of reservoir construction. Suggestions are given for easing the burden of relocation among those af-fected. The framework for this report is longitudinal, describing the relocation process from pre-migration to post-relocation. (Grieves - Kentucky) W74-03204

# **Group 6B—Evaluation Process**

COMPARATIVE ANALYSIS OF RESIDENTIAL

WATER USE IN PUERTO RICO, Puerto Rico Univ., Mayaguez. Water Resources Research Inst

For primary bibliographic entry see Field 06D. W74-03324

HUMAN FACTORS INVOLVED IN THE DEVELOPMENT OF A WATERSHED IN YABU-COA,

Puerto Rico Univ., Mayaguez. Water Resources Research Inst.

F. del Rio, J. Collazo, A. T. Berrios, and N. L. Garcia

Available from the National Technical Information Service as PB-227 482, \$7.25 in paper copy, \$1.45 in microfiche. Technical Completion R July 1970. 72 p, 65 tab. OWRR A-013-PR (1). on Report,

Descriptors: \*Social aspects, \*Watershed management, \*Attitudes, \*Puerto Rico, Social change, Social participation. Water resources development, Flood control, Flood damage, Population, Farms, Surveys, Income, Community develop-ment, Rural sociology.

Identifiers: \*Guayanes River Watershed (P.R.).

A watershed project, including measures designed to eliminate floodwater damage to land, homes, roads, and bridges, was planned for the Yabucoa region in Southeastern Puerto Rico. The area has suffered severe economic loss of property and lives as a result of heavy floods in the past. Many projects, no matter how structurally sound, have failed when the views of the community involved were ignored, when they did not understand the innovations and when they felt that their security was threatened. This study attempts to: determine some of the personal characteristics of the people of the area in terms of age, education, occupation, income, family size and levels of living; characterize the community in terms of socio-psychological factors including community solidarity and cohesion, population mobility, and their attitude toward the present and future; ascertain the knowledge, attitudes, and opinions of the people toward the Guayanes River Watershed Project; determine the farming situation of the area; and arrive at conclusions and formulate suggestions which may help in the program development process and in the evaluation of the watershed project. Researchers envisage that results of this study will assist in counteracting difficulties which may arise in the development of the project. (Slattery-Wisconsin) W74-03325

USER ATTITUDES TOWARD WATER QUALI-TY AND PRICE, LAS VEGAS VALLEY AND RENO-SPARKS, NEVADA, Nevada Univ., Reno. Desert Research Inst.

For primary bibliographic entry see Field 05G. W74-03331

INVESTIGATION OF THE PUBLIC AND PRIVATE INTERESTS IN THE CHESAPEAKE

BAY AREA, Maryland Univ., College Park. Dept. of Agricultural and Extension Education.

James W. Longest.

Available from the National Technical Information Service as PB-226 767, \$4.25 in paper copy, \$1.45 in microfiche. Maryland Water Resources Research Center, College Park, Technical Report No. 16, February 1973. 33 p, 2 fig, 26 ref, 3 append. OWRR A-010-MD (1). 14-01-0001-1840.

Descriptors: \*Administration. \*Comprehensive Planning, \*Decision making, Methodology, \*Maryland, Social participation, Social values, \*Chesapeake Bay, Water utilization, Bays. Identifiers: \*Management control system

Conflicts often result because of varying goals among water resources users. A management control system is an attempt to bring users together to develop, evaluate and implement goals and programs related to common resources. Selected elements of an Organizational and Management Concents Classification System developed for use in examining management problems of Chesapeake Bay are described. The model yields a frame to classify social, political and economic entities found in the area. Discussion centers primarily on user responsibilities, system responsibilities and integration as signs of the system's effectiveness Each user is involved to varying degrees with the planning, development, communication, enact-ment and endorsement of the common system . This involvement may be charted to measure the degree of active user participation. The management system seeks to encourage socialization of the community to the system goals. This includes changing attitudes, maintaining linkages and dividing tasks among users according to their own expertise. (Schroeder-Wisconsin) W74-03332

THE GENERATION OF FLOOD DAMAGE

TIME SEQUENCES, Kentucky Water Resources Inst., Lexington. For primary bibliographic entry see Field 04A. W74-03334

METHODS OF THE CALCULATION OF COST--BENEFIT IN THE CONSTRUCTION OF SEAPORTS,

Z. Fedorowicz. Public Finance, Vol 27, No 2, p 190-195, 1972.

Descriptors: \*Cost-benefit theory, \*Harbors, Coastal structures, Coastal engineering, Gross National Product, Foreign trade, Transportation,

Ships, Access routes.

Identifiers: \*Seaport construction, Transshipping.

A number of political, economic, and social considerations often require development of sea transportation and ports. Parallel decisions on industrial development determine port capacity and construction time through a complicated costbenefit analysis. A separate analysis is also necessary in choosing between alternative ports meeting these requirements. Each alternative stipulates maximum allowable ship size, and transshipment organization, and facilities which determine investment costs, current exploitation costs and revenues derived from fees and services. The use of benefit-cost analysis on choosing between ports is advocated, while suggesting modifications to ac-count for peculiarities of this investment. These problems arise in part because of the length of the investment and because alternatives may vary not only in terms of total investment but also in terms of the amount of frozen investment over time and its impact on national income. The modified ratio includes the discounted impact on national income of the alternatives. The need to vary the discount ratio over time is also mentioned. Emphasis is given to the need to account for the sizable indirect benefits which arise, including increased shipping revenue, increased transhipping revenue, and decreased expenditures to foreign shippers. (Schroeder-Wisconsin)

COMING TO TERMS WITH GROWTH AND

W. W. Heller.

In: 'Energy, Economic Growth, and the Environment,' forum conducted by Resources for the Future, Inc., April 20-21, 1971, Washington, D.C., p 3-29. 18 ref. Descriptors: \*Gross national product, \*Ecology, \*Welfare (Economics), \*Energy, Regulation, Taxes, Pricing, Costs, Pollution abatement, En-Identifiers: \*Economic growth.

A number of perceptual differences between ecologists and economists must be reconciled if any joint attach on growth-energy-environment problems is to succeed. Ecologists view an end to economic growth as an environmental imperative. Economists, however, view the structures other than growth as the cause of existing evils. While it seems impossible to see an end of growth, it is essential that the public knows the trade-offs it faces. It is almost certain that such an end will increase tensions between societal groups. It must also be questioned whether environmental decay can be reversed without growth. A second difficulty arises from the economists' use of GNP as a measure of public well-being. The ecologists' contention that existing GNP increases are solely the result of resource depletion cannot be substantiated; however, weaknesses in the measure have led to suggestions for changes in standards in order to reflect social performance. When government intervention is justified, ecologists and economists differ in their choices; choosing regulation or taxation respectively. Economists favor the latter because of its low costs and efficiency implications. Both must consider distributional im pacts of any proposed changes. (Schroeder-Wisconsin) W74-03465

MANAGEMENT SCIENCE IN THE DEVELOP-ING COUNTRIES: A COMPARATIVE PROACH TO IRRIGATION FEASIBILITY, Italconsult, Rome (Italy). For primary bibliographic entry see Field 03F.

W74-03471

AGGREGATES AND EXTERNALITIES: INFOR-MATION NEEDS FOR PUBLIC NATURAL RESOURCE DECISION-MAKING. Resources for the Future, Inc., Washington, D.C. W. B. Lord, and M. L. Warner.

Natural Resources Journal, Vol 13, No 1, p 106-

Descriptors: \*Decision making, \*Planning, U.S. Water Resources Council, \*Natural resources, Income distribution, Economic efficiency, Cost-benefit analysis, Optimization, Equity, Social par-

Identifiers: National Environmental Policy Act, \*Externalities, Diversity, Closure.

Natural resource decision-making in the United States is viewed as pluralistic, problem solving, and locally oriented. Two different levels of concern arise from natural resource use decisions, in addition to the concern that the original problems be resolved satisfactorily. The first is specific to a particular decision and is normally expressed by persons or groups likely to be affected quite directly by the decision. Concerns at the second level involve effects acting over longer time intervals on all segments of society. The notion of constrints is proposed over the use of optimizing techniques to address these natural resource problems. Constraints in natural resource decision-making include economic efficiency, income distribution, equity, diversity and closure. Economic efficiency requires that an honestly computed benefit/cost ratio be greater than unity. Income distribution would require that a proposed action not result in a less equal distribution of money incomes than would prevail in its absence. Equity would require that the costs of pursuing a particular action be borne by those who would benefit by it. Maintenance of diversity represents a hedge against uncertainity by preserving a wide variety of options and potentials. Closure requires some provision be made for amelioration of all potentially harmful physical by-products of the action under study. (Slattery-Wisconsin) W74-03474

NORTH COASTAL AREA INVESTIGATION. SOUTH FORK EEL RIVER STUDY: A SUMMARY OF THE PUBLIC HEARING COMMENTS ON THE PRELIMINARY EDITION DATED JANUARY 1968, FINAL SUPPLEMENT, California State Dept. of Water Resources, Sacra-

B. J. Smith, and E. A. Pearson. Bulletin No. 173, December 1969. 20 p.

Descriptors: \*Water resources development, \*Water supply, Flood control, Recreation, Fish conservation, Water management (Applied), Reservoir operation, Cost-benefit ratio, \*Califor-

Identifiers: \*Public hearing, \*Eel River (Calif.).

public hearing on the results of the South Fork Eel River Study was held jointly by the California Water Commission and the California Department of Water Resources in May, 1968 at Redv objective of the study was to analyze possible water development projects in the basin which might be constructed for local water supply, flood control, recreation, and fisheries enhancement.

Comments made at the hearing were directed toward the two developments in the basin that were found to be economically justified: Cahto Reservoir Project on Tenmile Creek and Panther Reservoir Project on the East Branch of the South Fork. The majority of people commenting saw the proposed projects as facilities that would help lure more recreationists into an area that has a sagi economy. Some opposition was voiced by landowners in the reservoir areas and by fishermen concerned about the effects of the projects on fishlife. Following the public hearing the Water Commission and Department of Water Resources agreed no further state funds be spent in planning for these projects inasmuch as the necessary recreation and fisheries enhancement funds were unavailable at that time. (Slattery-Wisconsin) W74-03476

CASTAIC LAKE AREA RECREATION DEVELOPMENT PLAN, California State Dept. of Water Resources, Sacra-

H. H. Murata, O. V. Holguin, and P. J. Yates. Bulletin No. 117-9, March 1970. 15 p, 1 fig, 2 tab.

Descriptors: \*Water resources development, \*Recreation demand, Recreational facilities, Reservoir storage, Boating, Fishing, Swimming, Camping, Costs, Cost-benefit ratio, \*California,

Dams.
Identifiers: \*Castaic Lake (Calif), Los Angeles
County (Calif), Hiking, Picnicking.

Castaic Lake, to be created by an earthfill dam across Castiac Creek, will be a major reservoir of the California State Water Project providing both emergency storage and regulation of water. It will also provide recreation opportunities for northwestern Los Angeles County. The lake will furnish room for high-speed boating, fishing, picnicking, camping, horsebackriding, hiking and sightseeing. The Downstream Pool, with an area of 180 acres of non-fluctuating water surface and environs will provide slow and quiet boating, pic-nicking, camping, swimming and fishing. Facilities will be completed at an estimated cost of \$11,655,000. The recreation use for the Castaic project has been computed by using data available at existing reservoirs and extrapolating those data to provide expectation use through the 50-year period of analysis. The preliminary benefit-cost ratio is 3.5 to 1.0, taking into consideration the variety and quality of recreation, and the aesthetic qualities of the site. (Slattery-Wisconsin) W74-03481

A GUIDE TO DECISION MAKING FOR WATER RESOURCES MANAGEMENT IN THE SAN AN-

San Antonio River Authority, Tex.

Interim Report No. 5, February 1971. 25 p, 8 fig.

Descriptors: \*Water resource development, \*Methodology, \*Decision making, \*Input-output analysis, Water utilization, Treatment facilities, Costs, Data processing, Data collections, Systems analysis, Project planning, Water demand, Groundwater resources, Return flow, Runoff. Identifiers: San Antonio (Texas).

Eight interrelated programs exist in water resources planning in the San Antonio region, each having data input and data output. Each centers around inventory analysis in which inputs, outaround inventory analysis in which inputs, outputs, and changes in storage are analyzed. The
Unit Demands Program provides a mathematical
evaluation of how water use patterns are effected
by annual rainfall, water quality, and water costs.
The Total Needs Program develops the total water
requirements and leftover water for the region.
The Leftovers Transportation Program provides
estimations of flow characteristics for all lines and waste treatment plants for any prespecified con-ceptual design. The Return Flow Analysis Proceptual design. The Return Flow Analysis rro-gram analyzes the capability of existing treatment facilities to handle imposed waste loads. The Soil Reservoir Program provides an estimation of the quantity and quality of runoff water resulting from rainfall. The Water Demand Alternatives Program evaluates the overall effects of meeting water requirements through utilization of groundwater surface water, return flow, or any combination of the three. The Surface Water Resources Analysis Program analyzes the effect of discharges, withdrawals, spring flow and runoff on the quality and quantity of water in streams and reservoirs. The Groundwater Resources Analysis Program analyzes the effects of water resource programs on the groundwater resources in the region. (Slat-tery-Wisconsin) W74-03484

AGRICULTURAL RECONNAISSANCE SUP-PLEMENT TO THE MILL CREEK DEVELOP-MENT PROJECT. Schick International, Morgan, Utah. For primary bibliographic entry see Field 06D. W74-03488

THE ECONOMIC IMPACT OF A DEEPWATER

TERMINAL IN TEXAS,
Texas A and M Univ., College Station. Industrial
Economics Research Div.

Economics Research Div. D. M. Bragg, and J. R. Bradley. Available from the National Technical Information Service as COM-73-10514, \$3.00 in paper copy, \$1.45 in microfiche. TAMU-SG-72-213, November 1972. 56 p, 24 fig, 27 tab, 29 ref. Sea Grant 2-35213.

Descriptors: "Harbors, "Offshore platforms, "Economic impact, "Texas, Oil industry, Costbenefit analysis, Input-output analysis, Costs, Benefits, Transportation.

Identifiers: "Deepwater terminal.

Construction of a deepwater facility will present a Construction of a deepwater facility will present a clear opportunity for growth to the industrial community in Texas. Expansion will occur in operations such as oil refining and petrochemicals manufacturing, which utilize oil and gas to produce finished products for export and domestic consumption. Firms engaged in activities related to the construction and operation of pipelines, in the provision of transportation services such as ship repair, and the supporting and servicing of the ship repair, and the supporting and services such as many petroleum-related industries will also grow. Without the deepwater terminal the primary impact to the state would be a loss of future job op-portunities for workers, reduced amounts of tax monies for public services and reduced levels of

activity throughout the economy. The benefit-cost potential of one or more deepwater terminals in Texas, ranging from 4.8:1 if only transportation costs savings are considered, to 238:1 cluding the economic impact should leave no doubt as to the desirability of these facilities. Components of a deepwater terminal include: a monobuoy, underwater and offshore pipelines, a platform with pumping equipment, onshore storage tanks and supporting equipment. (Slattery-Wisconsin) W74-03489

FLOODPLAIN LANDS FOR PARKS AND RECREATION: A CASE STUDY OF MILWAU-

KEE, Wisconsin Univ., Madison.

E. J. L. David. Land Economics, Vol 49, No 2, p 221-226, 1973. 1

Descriptors: \*Flood plains, \*Recreation, \*Cities, Costs, Project benefits, Parks, Boating, Fishing, Swimming, \*Wisconsin. Identifiers: \*Milwaukee (Wis).

Research indicates that flood plains are not necessarily a valuable source of recreation land for metropolitan areas. Milwaukee is used as a case study. Although flood plain land provides an ideal setting for particular kinds of recreational activities, e.g. water-based activities such as boating. fishing and swimming, and will benefit the taxpayer in terms of lower land acquisition costs for the city, there are disadvantages. The kinds of water-based recreation which the rivers provide are limited and flood plain parks are readily available only to a select group of people. Inequities occur both because they are less readily accessible to lower income residents and because flood plains are not uniformly scattered. Emphasis on outdoor flood plain recreation overlooks recreational outlets requiring much less space which seem to be more appropriate for urban areas. This does not mean that flood plains should not be bought for recreational opportunities but does suggest that a much broader spectrum of park and recreational opportunities must be included if recreation for the metropolitan area is to be adequately provided for. (Slattery-Wisconsin) W74-03491

ECONOMIC GROWTH AND ENVIRONMENTAL DECAY: THE SOLUTION BECOMES THE PROBLEM,

Washington State Univ., Pullman. Dept. of Agricultural Economics. P. W. Barkley, and D. W. Seckler. Harcourt Brace Jovanovich, New York, 1972. 193 p, 31 fig, 4 tab, 73 ref.

Descriptors: \*Environmental control, \*Economic impact, \*Pollution abatement, Costs, Environ-ment, Benefits, Cost analysis, Cost-benefit analysis, Market value, Gross national product, Income distribution, Pollution taxes (Charges), Recrea-

Identifiers: \*Economic growth, Resource depletion, Externalities, Supply and demand.

Growing economies face environmental deterioration because encroachment on natural resources is one of the first prices to be paid for economic growth. The most common measure of growth is defined to include, in a positive way, things ac-tually detrimental to health, happiness, and the environment. The GNP measures the output of an economy, but this includes negative environmental output such as collecting garbage, the costs of driving to get away from congestion and the cost of cleaning up polluted streams. Thus, the process of growth brings with it unintended aspects — externalities, loss of collective goods, and the potential impoverishment of future generations. Insofar as these imperfections exist, market prices will not

# Group 6B—Evaluation Process

accurately signal values, and insofar as growth continues under these irrational prices, society is led away from its desired state. Modern economic theory shows that the growth rate of an economy can now be controlled through injections and withdrawals of money in the system and by a variety of other monetary devices. Thus, society can pick its rate of economic growth from a large range of alternatives. If the natural environment is to be maintained, a lower economic growth rate must be selected. (Slattery-Wisconsin) W74-03492

POLLUTION: ECONOMY AND ENVIRON-

MENT, Kent Univ., Canterbury (England). Dept. of Economics.

P. A. Victor. University of Toronto Press, 1972. 247 p, 48 tab, 163 ref

Descriptors: \*Input-output analysis, \*Environment, \*Methodology, \*Economics, Waste disposal, Industrial production, Industrial wastes, Model studies, Canada, Water utilization, Water pollution, Air pollution, Transportation, Pollu-

Identifiers: Commodities, Ayres-Kneese model, Cumberland model, Daly model, Isard model, Leontief model, Rosenbluth model, Dominion Bureau of Statistics model

The connections between human society, and the rest of the universe that are attributable to economic activity, are examined. These include the inputs from the environment to industry, such as oxygen, used in the combustion of mineral fuels and industrial outputs which are fed back into the environment in the form of waste products. Functional relations between the extent and character of economic activity and the flow of materials in both directions between the economy and the environment are established. The interactions of economic activity and the environment are examined in the literature on the construction of models and in commodity-by industry input-out-put models. Examples of the use of economicecologic input-output models are illustrated. The study shows that existing economic models can be extended, both theoretically and empirically, so that the quality and quantity of these material flows become determined by the economic activity of society. An empirical survey of the use of water and the production and disposal of wastes in Canada for the year 1961 is also included. (Slattery-Wisconsin) W74-03493

#### THE CALIFORNIA STATE WATER PROJECT IN 1968.

California State Dept. of Water Resources, Sacramento.

J. H. Jaquith.

Bulletin No 132-68, June 1968. 379 p, 7 fig, 51 tab, 3 append.

Descriptors: \*Water supply, \*Water resources development, \*State governments, \*Costs, \*California, Aqueducts, Dam construction, Operation and Maintenance, Bond issues, Financing, Administration.

Progress on the construction, operation, financing and management of the California State Water Project is reported. Oroville Dam is the key water conservation feature of the project. Storage of water began in November 1967. Water deliveries through Phase II of the North Bay Aqueduct were initiated in Napa County. One-half of the construction of the 444-mile mainline of the California Aqueduct is complete, together with the first 15 miles of the Coastal Branch. Water deliveries are also being made to agencies in the arid side of the San Joaquin Valley. The Project's water rights applications were approved. Contracts were

completed for the nurchase of Northwest power to supplement the power supply for pumping project water. A contract for the sale of high-value Oroville-Thermalito power was executed with the California Power Pool Companies. Execution of the power sale contract permitted the first sale of revenue bonds. Additional construction funds totaling \$219 million are expected to be derived from the proceeds of such sales. In spite of this, a long-term financial deficiency of \$269 million is indicated. The estimated total capital cost of the Project, exclusive of future design and construction costs for the San Joaquin Drainage Facilities, is \$2,778 million. (Slattery-Wisconsin) W74-03502

UPPER EEL RIVER DEVELOPMENT. IN-VESTIGATION OF ALTERNATIVE CON-VEYANCE ROUTES,

California State Dept. of Water Resources, Sacra-

J. M. Youngerman, M. P. Price, K. R. Henneman, and T. L. Hanson. Bulletin No 171, August 1967. 80 p, 19 fig, 13 tab.

\*Water resources development. Descriptors: \*\*California, \*Project planning, Diversion, Reservoirs, Water supply, Conveyance structures, Project benefits, Costs, Cost-benefit ratio, Water yield, Benefits, Recreation, Flood control, Alteration of flow, Alternative planning, Future planning (Projected), Watershed management. Identifiers: \*Eel River (Calif), State Water Project

The Glenn Route is, by engineering and economic standards, the best route for conveyance of Middle Fork Eel River water to the Sacramento-San Joaquin Delta for use in the California State Water Project by the year 1990. Water will flow from the Middle Fork Eel River east through Glenn and Tehama Counties to the Sacramento River and then to the Delta. The alternative route investigated would have through Clear Lake and down the Sacramento River either through Cache Creek or Putah Creek. The alternative Glenn and Clear Lake conveyance routes were compared for a wide range of sizes using traditional benefit-cost standards for economic comparison. Routing water from reservoirs on the lower Eel River to the Sacramento Valley via the Glenn reservoirs rather than via Clear Lake would result in ap-preciable cost savings. Other factors taken into consideration were: water quality, flood control, recreation, local water needs, fisheries and wil-dlife habitat, and hydroelectric power. The most likely plan of development for the Glenn Route is a combination of Dos Rios Reservoir on the Middle Fork Eel River, the Dos Rios-Grindstone Tunnel, and features of the Gleen Reservoir Complex. Several damsites were rejected because of high costs and uncertainties regarding competance of foundation materials. (Slattery-Wisconsin) W74-03503

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME I: METHODOLOGY ANALYSIS OF

Alamo Area Council of Governments. San Antonia. Tex.

Interim Report No. 16. December, 1971. 48 p, 4 fig, 17 tab.

Descriptors: \*Texas, \*River basins, \*Regional development, \*Management, \*Planning, quality control, Aquifers, Water resource development, Coordination, Groundwater, Projections, Water demand, Environmental effects, Costs, Computer models, Sewerage, Land use.

Computer mouers, sewerage, Lanu use.

Identifiers: Bexar County (Texas), Edwards Underground Reservoir, Nueces River Basin, Guadalupe River Basin, Carrizo-Walcox Aquifer, Urban water utilization, "San Antonio River basin.

Objectives of this plan are to provide most cost effective water resource management strategies for meeting projected water uses and maintaining water quality criteria throughout the Alamo Area Planning Region which encompasses the San Antonio Metropolitan region with 90% of the population residing in Bexar County. The planning program is particularly concerned with establishing a continuing planning process which can be easily updated, and with defining a framework for federal, state, and local coordination. Volume I of this report provides a classification of each water resource area. Emphasis is placed on using exist-ing river basin programs and water quality stan-dards. The planning methodology includes long range population forecasting, land use forecasting, identification of water service areas and demands, analysis of water service areas and demands, analysis of water sources, Carrizo Sands Aquifer, Edwards Underground Reservoir, Guadalupe River Basin, Nueces River Basin and the San Antonio River Basin, and their relation to demands, the estimation of the costs of alternative water resources projects until 2000, and the determination of environmental effects from these projects. Computer models are used to simulate environmental effects and quickly estimate costs of alternative land use patterns and proposed water resource systems, especially sewerage systems. Possible elements of an overall management strategy include regional water and sewerage systems, water diversions, wastewater reuse, and land use controls. (See also W74-03643 and W74-03644) (Elfers-North Carolina) W74-03642

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME II: URBAN WATER-RELATED SER-

Alamo Area Council of Governments, San An-

Interim Report No. 17. December, 1971. 88 p, 27

Descriptors: \*Planning, Water resource development, \*Management, \*Land use, \*Water demand, \*Costs, \*Texas, Regional development, Projections, Urbanization, Construction costs, Water quality control, Sewerage, Water supply, Irrigated

Identifiers: Bexar County (Tex), Service areas, San Antonio (Tex).

Focus is on urban water-related services, determining the costs for constructing new water dis-tribution, wastewater collection, and storm water drainage facilities throughout the region. Each of the thirteen counties in the region is examined separately with emphasis on irrigated acreage, urbanization trends, the required water management facilities, and the probable costs of these facilities for the next thirty years (to 2000). The need for the facilities is based on the population and land use forecasts from Volume I of the overall report. The costs of providing the facilities are largely deter-mined from analyzing historical costs and are estimined from analyzing instorical costs and are esti-mated on a per acre basis, e.g. \$500 per acre for new urbanized areas, \$100 per acre for existing ur-banized areas to provide water distribution facili-ties; cost of waste water collection (excluding lines less than 12"): \$250 for new urbanized areas, \$50 per acre for existing urbanized areas; cost of storm water drainage: \$500 per acre for total urban area. Service area maps for each county and numerous tables of cost data by service area are included. (See also W74-03642) (Elfers-North Carolina) W74-03643

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME III: SHORT RANGE PROGRAM 1970-

Alamo Area Council of Governments, San Antonio, Tex.

December, 1971. 9 p, 9 tab.

Descriptors: \*Costs, \*Project planning, \*Texas, Planning, Programs, Water supply, Sewerage, Drainage systems, Flood Control, Regional

Identifiers: Implementation, \*Capital improve-ments, Bexar County (Tex), \*San Antonio (Tex).

A short range program is presented for implementing the water resource management plan for the San Antonio Metropolitan Region presented in the first two volumes. The implementation program covers the period from 1970 to 1975 and is presented in some detail for the City of San Antonio and eight counties in the planning region. Each implementation program includes a brief description of the plan elements or projects to be undertaken during the period, the estimated cost, and a reference to other reports for more detailed information. The implementation program for Bexar County, the most urbanized county in the region, includes elements for water distribution, wastewater collection, and storm water drainage in several urbanizing parts of the county and flood in several urbanizing parts of the county and flood control projects for the City of San Antonio. Estimated cost is \$40,750,000. Proposed storm drainage capital improvements program for the City of San Antonio is estimated to cost \$18,518,759. (See also W74-03642) (Elfers-North Carolina) W74-03644

WATER FACILITIES FOR EAST ORANGE AREA FOR CITY OF ORANGE AND EAST ORANGE COUNTY WATER DISTRICT. Boyle Engineering, Santa Ana, Calif. For primary bibliographic entry see Field 03D. W74-03648

THE WYOMING FRAMEWORK WATER PLAN, A SUMMARY. Wyoming State Engineer's Office, Cheyenne.
Water Planning Program.

May 1973, 24 p.

Descriptors: \*Wyoming, \*Planning, \*Long-term planning, Water utilization, Water demand, \*Projections.

The Wyoming Framework Water Plan identifies the long-range (50-year) alternatives for meeting the water needs of the State. It is an inventory of the State's water resources and related lands, a summary of the State's present water uses, a projection of future water needs, and an identification of alternative decisions to meet or not to meet the indicated future water needs. This report is a summary of the Wyoming Framework Water Plan.

SOCIO-ECONOMIC CONSIDERATIONS IN WATER RESOURCES PLANNING, Department of the Environment, Ottawa (Ontario). Ecological Systems Research Div.

A. K. Biswas. Water Resources Bulletin, Vol 9, No 4, p 746-754, 1973. 1 fig, 21 ref.

Descriptors: \*Social participation, Decision making, Social values, Water resources development, Income distribution, \*Planning, Cost-benefit analysis, \*Management.
Identifiers: \*Public participation, Environmental

quality.

The objectives of water resource planning and management have increased over the years. Early activities had as their objective economic efficiency with benefit-cost analysis being their chief analytical technique. The addition of other objec-tives has broadened the planning framework and is the result of an attempt to bring in greater public participation. These objectives include regional income redistribution, environmental quality and social well-being. The addition has not been without problems. Measurement of increases and decreases towards these objectives is difficult and highly subjective. Furthermore, multiple objectives are not mutually exclusive, and trade-offs must be made between them. The designing of a system to maximize one of the objectives subject to specified levels of performance of the others is suggested as a way to overcome this difficulty. The planning process is designed to specify and meet the needs of the public. Increased public ticipation is used to articulate these needs. The difficulty of designing a system to include public par-ticipation is briefly discussed. (Schroeder-Wiscon-W74-03745

CHANGING ATTITUDES IN W DEVELOPMENT IN WATER PESOURCES THE

PROVINCE OF MANITOBA,
Department of Mines and Natural Resources, Winnipeg (Manitoba).

Water Resources Bulletin, Vol 9, No 3, p 607-612, 1973. 1 fig.

Descriptors: Decision making, \*Social values, Planning, Environmental effects, Social adjustment, \*Water resource planning, \*Canada, North Dakota, \*Attitudes, \*Social change. Identifiers: Public concern, Manitoba, Saskatchewan River, Nelson-Churchill River

Saskatchewan River, Nelson-Churchill River Complex, Pembina River Basin, Saskatchewan-Nelson River Basin.

The Province of Manitoba is endowed with vast water resources. Their use in the production of power and for municipal and industrial purposes has grown steadily since the province's settlement in the 19th century. While economic concerns have been predominant in the development of Manitoba's water resources, the 1960's signaled a period of increasing concern over possible en-vironmental effects of water control and water resource development projects. The change in at-titude of the public during the 1960's towards ecological and environmental aspects of proposed projects and the government's response to these concerns are described. These public concerns are noted in proposed hydroelectric plants on the Saskatchewan River at Grand Rapids, and the Nelson-Churchill river complex where a 1971 study agreement established an interdisciplinary group to evaluate the environmental effects of the proposed project. Additional projects mentioned include the extensive flood control program initiated in 1962, the Joint Commission report between North Dakota and Manitoba investigating the Pembina River Basin and the five million dollar water supply study of the Saskatchewan-Nelson Basin begun in 1967 by Canada and the Provinces of Manitoba, Saskatchewan and Alberta. (Schroeder-Wisconsin) W74-03747

RESERVOIRS AND LOCAL GOVERNMENT

FINANCE, Georgetown Coll., Ky. Dept. of Economics. C. T. Bates, and D. M. Soule. In: Growth and Change, University of Kentucky, p 47-51, 1971. 1 tab, 4 ref. OWRR A-006-KY (12).

Descriptors: \*Multi-purpose reservoirs, \*Taxes, Water resources development, Government finance, "Reservoir construction, Regional economics, "Local governments, "Kentucky. Identifiers: "Tax severity index.

Not all economic changes related to development of multipurpose reservoirs are desired. A com-monly held belief to be tested is whether reservoir development causes local taxes to become more severe because demands for government services increase relative to the local area's ability to pay. A severity index equal to the percentage increase

in local tax revenue divided by the percentage increase in local taxpaying ability (full value of taxa-ble property and personal income) is introduced. Three reservoirs in Kentucky are studied over a period from one year prior to initial land acquisi-tion to one year following construction of the dam. Percentage changes are shown for property tax revenue, full value of taxable property and per-sonal income for the county and school governsonal income for the county and school govern-ments plus statewide averages for county and school governments. The computation of the tax severity index showed generally low values for the ratios in two of the three project areas. Four factors explain this phenomenon: (1) increasing property values; (2) less than anticipated increases in demands for government services and the existence of some unused capacity in government facilities; (3) development of new revenue sacutues; (3) development of new revenue sources, including changes in state aid-to-education funds; and (4) the extended period in which development took place. (Schroeder-Wisconsin) W74-03748

# 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MINIMUM COST DESIGN OF WATER DIS-TRIBUTION SYSTEMS, Kentucky Water Resources Inst., Lexington.

For primary bibliographic entry see Field 08A. W74-03205

POLITICAL AND ENVIRONMENTAL ATTITUDES OF VOTERS AND PUBLIC OFFI-CIALS RELATED TO ALTERNATIVE LEVELS OF WATER QUALITY AND CORRELATIVE LEVELS OF MANAGEMENT OF THE PENOB-

Maine Univ., Orono. Dept. of Political Science. For primary bibliographic entry see Field 05G. W74-03323

NOMOGRAPHS FOR THERMAL POLLUTION

CONTROL SYSTEMS, Hittman Associates, Inc., Columbia, Md. For primary bibliographic entry see Field 05D.

USER ATTITUDES TOWARD WATER QUALI-TY AND PRICE, LAS VEGAS VALLEY AND RENO-SPARKS, NEVADA,

Nevada Univ., Reno. Desert Research Inst For primary bibliographic entry see Field 05G. W74-03331

GROUNDWATER VERIFICATION OF CAPITAL COSTS New Hampshire Univ., Durham. Water Resources For primary bibliographic entry see Field 04B. W74-03338

A DYNAMIC PROGRAMMING--SIMULATION STRATEGY FOR THE CAPACITY EXPANSION OF HYDROELECTRIC POWER SYSTEMS, Stanford Univ., Calif. Dept. of Civil Engineering. For primary bibliographic entry see Field 08C. W74-03470

THE ANCHOVY CRISIS,

C P IdvII Scientific American, Vol 228, No 6, p 22-29, 1973.

Descriptors: \*Marine fisheries, \*Upwelling, Fishkill, Fish management, Commercial fishing, Fish harvest. Identifiers: \*Anchovies, El Nino, \*Peru, Hum-boldt Current, \*Chile.

# Group 6C-Cost Allocation, Cost Sharing, Pricing/Repayment

Peruvian anchovies live in the northern coastal currents which run 2000 miles from Valparaiso, Chile to Chimbote, Peru. The northward flowing water is cold, partially the result of subartic water but primarily because of a natural phenomenon, upwelling. Through upwelling, prevailing winds sweep away surface water and replace it with colder deeper water rich in nutrients. As a result, an excellent environment is created for marine an excellent environment is created for marine life. This small fraction of the ocean produces nearly 20 percent of all the fish caught in the world. Two problems presently confront the anchovies. The first, El Nino, is a natural phenomena, shifting the winds, decreasing upwelling and warming the water. This disruption of the rich environment has in past periods both reduced and scattered the anchovies making it more difficult for man and natural predators such as the guanobirds to harvest them. The excess growth of commercial fishing also threatens the anchovies. In 1970, the 12.3 million ton catch greatly exceeded the 10 million level estimated to be the maximum sustainable yield. These two factors have placed the anchovy fishery in an uncertain future. (Schroeder-Wisconsin) W74-03473

ANALYSIS OF COSTS OF POLLUTION CON-TROL

Organization for Economic Co-Operation and Development, Paris (France).

For primary bibliographic entry see Field 05G. W74-03486

ECONOMIC BENEFITS FROM IRRIGATION, Texas Tech Univ., Lubbock. Dept. of Agricultural

Economics. I E Osborn

In: Proceedings of Tenth Annual West Texas Water Conference, Lubbock, p 51-56, 1972. 4 tab.

Descriptors: \*Economic impact. \*Crop produc-\*Irrigation, Irrigated land, Agriculture, tion, Groundwater resources, Direct benefits, Indirect

Identifiers: \*Texas High Plains region.

As of 1967 a major source of new capital in Texas was agriculture. Production from agriculture has increased significantly with irrigation. The number of irrigated acres increased from approximately 250,000 in 1940 to nearly five million acres in 1967. However, the source of irrigation water is an exhaustible groundwater supply so there are serious long range problems present for replacing this source of capital. The economic importance of irrigation to the region was indicated by the value of the crop production. In 1967, the value of crop production was \$775.8 million. Nearly 82 percent of the value of crop production was associated with irrigation. Increases in crop production that can be associated with irrigation provides a series of results in spending in the region. This economic impact of irrigation can be separated into direct, indirect, and stemming-from benefits. The estimated economic benefits from irrigation on crops in the Texas High Plains was \$1,561.1 million. The direct economic benefit to resource owners is \$363.1 million. The beneficiaries of the indirect and stemming-from economic benefits of \$1198 million, include suppliers, consumers and processors. (Slattery-Wisconsin) W74-03487

THE POLLUTION CONTENT OF AMERICAN

New York Univ., N.Y.
For primary bibliographic entry see Field 05G. W74-03490

UPGRADING LAGOONS, Brown and Caldwell, San Francisco, Calif. For primary bibliographic entry see Field 05D. W74-03495 OXYGEN ACTIVATED SLUDGE WASTE-WATER TREATMENT SYSTEMS: DESIGN CRITERIA AND OPERATING EXPERIENCE Union Carbide Corn. Tonawanda, N.Y. Linde

For primary bibliographic entry see Field 05D. W74-03496

PRETREATMENT OF POULTRY PROCESSING **UPGRADING** -PROCESSING FACILITIES TO REDUCE POL-

For primary bibliographic entry see Field 05D. W74-03497

IN-PROCESS POLLUTION ABATEMENT: UP-GRADING POULTRY-PROCESSING FACILI-TIES TO REDUCE POLLUTION, Environmental Engineering, Inc., Gainesville, Fla.

For primary bibliographic entry see Field 05D. W74-03498

WASTE TREATMENT: UPGRADING METAL--FINISHING FACILITIES TO REDUCE POLLU-

ancy Labs., Inc., Zelienople, Pa. For primary bibliographic entry see Field 05D. W74-03499

EXISTING TREATMENT PLANTS: CASE HISTORIES, Hazen and Sawyer, New York. For primary bibliographic entry see Field 05D. W74-03500 UPGRADING WASTEWATER

THE CALIFORNIA STATE WATER PROJECT

California State Dept. of Water Resources, Sacramento.

For primary bibliographic entry see Field 06B. W74-03502

PULP AND PAPER MILL WASTES TREAT-MENT; ALTERNATIVES AND COST ECONOMICS,

Central Public Health Engineering Research Inst., Nagpur (India).

For primary bibliographic entry see Field 05D. W74-03548

POLLUTION CONTROL AND THE BEHAVIOR OF THE FIRM--A TECHNICAL NOTE. Colorado State Univ., Fort Collins.

For primary bibliographic entry see Field 05G.

# 6D. Water Demand

COMPARATIVE ANALYSIS OF RESIDENTIAL WATER USE IN PUERTO RICO, Puerto Rico Univ., Mayaguez. Water Resources

Research Inst. A. Guilbe

Available from the National Technical Information Service as PB-226 768, \$4.25 in paper copy, \$1.45 in microfiche. Completion Report, November 1972. 93 p. 18 fig. 23 tab, 14 ref. OWRR

Descriptors: \*Analysis, \*Water utilization, \*Estimating, \*Model studies, Cities, Urban sociology, Surveys, Water demand, \*Puerto Rico. Identifiers: Public housing, Private housing, Ponce (P.R.), San Juan (P.R.), Mayaguez (P.R.).

This study was conducted with the objectives of developing residential water use models for Ponce and San Juan, Puerto Rice, and comparing these models with a previously developed model for Mayaguez, Puerto Rico. The results of this study have shown the feasibility of estimating water use in private residential developments based on property value as the basic characteristic. The rationale employed was that assessed value of property serves well as an indirect practical indicator of the effect on water use of such socioeconomic factors as number and kind of home water-using fixtures, lawn and garden areas, automobile washing requirements, education, habits, occupation and effective family buying income. Significant differences were observed in comparing private urbanization models for Ponce and Mayaguez and San Juan and Mayaguez respectively. It is there-fore recommended that separate models by em-ployed for estimation purposes in these cities. No significant differences were noted for the generated models of the three cities in the public dwellings areas. Thus, a single model is recommended for water use estimation purposes in these areas. (Slattery-Wisconsin)

THE IMPACT OF POLICY VARIABLES ON RE-SIDENTIAL WATER DEMAND AND RELATED INVESTMENT REQUIREMENTS.

Toronto Univ. (Ontario). Inst. of Environmental Sciences and Engineering.

A. P. Lino Grima, and P. Lino.

Water Resources Bulletin, Vol 9, No 4, p 703-710, 1973. 3 tab. 15 ref.

Descriptors: \*Water demand, \*Investment, \*Ur-banization, \*Mathematical models, \*Water supply, Regression analysis, Water rates, Model studies, Prices, Marginal costs. Identifiers: \*Residential water demand, Water me-ter. Lines assurtional Les librar constituers.

ters, Linear equations, Log-linear equations.

It is estimated that \$5,834 million will be invested to adequately provide urban water in 75 developing countries during 1961-75, with \$10,200 million to be spent in the U.S. in 1956-65. Fitted log-linear equations are estimated for home water use to investigate how investment costs might be reduced. Independent equation variables include assessed residential value, persons per dwelling, variable water prices and fixed water bill per period. Except for the fixed bill, all regression coefficients were significant at the 0.01 percent level. The resultant equations predictive capacity is illustrated for additional data. The effect of several pricing policies on demand are examined. Price elasticity varys from one to slightly less than one for the summer and winter respectively. The imposition of metering reduces operating and invest-ment costs through decreased demand. However, metering incurs additional purchasing, installation and reading costs. Marginal cost pricing is also examined to make investment more efficient. Nonprice alternatives to reduce demand, including reductions in plumbing fixture capacity and oddeven day lawn sprinkling, are also considered with the latter shown in Toronto to reduce maximum summer demand by nearly 20 percent. (Schroeder-Wisconsin)

RECREATIONAL DEMAND AT LAKES AND RESERVOIRS, Eno Foundation for Transportation, Inc. Sau-

gatuck, Conn.
G. E. Kanaan, and H. J. Day.
Journal of the Urban Planning and Development

Division, American Society of Civil Engineers, Vol 99, No UP2, p 265-269, 1973. 2 tab, 5 ref.

Descriptors: \*Recreation demand, Economic justification, Mathematical models, Reservoir operation, Lakes, Data collections, Reservoir operation, Lakes, Data collections, Reservoirs, \*Estimated benefits, Water resources development, Clites, \*Project planning, Parks, \*Ohio Identifiers: Dayton (Ohio), Great Miami River basin (Ohio).

Recreational benefits from water resources projects are continuously being incorporated into urban planning studies. Measurement of these benefits is difficult because they are usually provided at no cost. A technique is developed and demonstrated to estimate recreational activity at new facilities with user data from existing state parks. Dollar benefits are found by placing arbitrary values on each recreational experience, similar to the procedures used by the Corps of Engineers and the Bureau of Outdoor Recreation. Demand is assumed to be a function of reservoir surface area. distance from metropolitan areas to reservoirs, reservation characteristics including campsite development, and recreational opportunities including fishing, swimming and boating. To illustrate the predictive capacities of the model, recreational activities of four Ohio reservoirs are estimated. The actual and predicted visitations for the four respectively are: 1,347,000 and 1,150,000; 1,170,000 and 1,300,000; 577,000 and 550,000; and 856,000 and 575,000. This technique may prove useful in cases of limited budgets which permit the acquisition of park attendance data only. (Schroeder-Wisconsin) W74-03480

CASTAIC LAKE AREA RECREATION

DEVELOPMENT PLAN,
California State Dept. of Water Resources, Sacramento

For primary bibliographic entry see Field 06B. W74-03481

AGRICULTURAL RECONNAISSANCE SUP-PLEMENT TO THE MILL CREEK DEVELOP-MENT PROJECT. Schick International, Morgan, Utah.

Available from the National Technical Information Service as COM-73-10384, \$3.00 in paper copy, \$1.45 in microfiche. Prepared for Utah Division of Water Resources and Grand County Commission, Moab., September 1971. 189 p, 3 fig, 43 tab, 8 maps, 6 append.

Descriptors: \*Water supply development, \*Irrigation, \*Agriculture, Analysis, Utah, Farm units, Crops, Livestock, \*Economic impact, Direct benefits. Indirect benefits.

Identifiers: Mill Creek (Utah), Moab Valley (Utah), Spanish Valley (Utah), Wilson Mesa (Utah), South Mesa (Utah).

Moab Valley, Spanish Valley, Wilson Mesa and South Mesa are major areas considered for development of agricultural resources in the Mill Creek area before the water enters the Colorado River. Studies show additional water can be made available for irrigation from further development of the Mill Creek water supply. This study presents the comparison of benefits each area would produce from irrigation. Physical and economic information on the organization of existing farming units, crops, and livestock production practices, and the location and suitability of lands for irrigation was obtained, organized and analyzed. Total net direct agricultural benefits from the irrigation development should exceed \$600,000 annually when existing farm enterprises are fully adjusted to a firm water supply and the new land is brought to the expected production level. \$390,000 annually should be derived from increased net return to land and management. Secondary benefits will be about \$423,500 annually. The estimated average lag time necessary to reach full direct benefits is four years. Present worth evaluation of the net direct benefits for project development ranges from 16.7 million dollars (using a 3 percent discount rate) and 4.0 million dollars (using a 10 percent discount rate). (Slattery-Wisconsin) W74-03488 MASTER PLAN FOR WATER SUPPLY, BUCKS COUNTY, PENNSYLVANIA, 1970.
Justin and Courtney, Philadelphia, Pa.
For primary bibliographic entry see Field 03D. W74\_03620

WATER STUDY, SANTA FE PLANNING AREA. Santa Fe City Planning Dept., N. Mex. For primary bibliographic entry see Field 04B. W74-03641

THE WATER RESOURCE MANAGEMENT PLAN FOR THE AACOG PLANNING REGION, VOLUME II: URBAN WATER-RELATED SER-

Alamo Area Council of Governments, San Antonio. Tex. For primary bibliographic entry see Field 06B. W74-03643

WATER SUPPLY AND DISTRIBUTION. Somerset County Planning Board, Somerville,

September, 1973. 180 p, 37 fig, 2 maps, 1 append.

Descriptors: \*Planning, \*Water supply, \*Water demand, \*Water distribution (Applied), Groundwater, Water quality, Urbanization, Land use, Soils, Geology, Coordination, Surface waters, Regional development, \*New Jersey, Reservoirs. Identifiers: Somerset County (N.J.), Raritan River, Passaic River Basin, Delaware and Raritan

Somerset County, strategically positioned within one of the world's most heavily urbanized areasbetween the constantly expanding New York and Philadelphia Metropolitan Region, is changing from a predominantly rural environment to an urban-suburban area. Water resources are seen as key determinants in formulating overall County policy. The basic purposes of this report are to coordinate water resource planning with the comprehensive planning process, to help create a County-wide water supply network, and to promote local and regional coordination. The approach is to review past water resource develop-ment in the County and then look at factors related to the future need for water supply systems. Chapto the ruture need for water supply systems. Chap-ters on groundwater and geology, surface water and water quality, existing water supply systems, present and future water demand, and a very general water supply plan are included. The recommendations of the plan include the interconnection of all public water supply systems, the discouragement of new, small water supply systems, the use of system extensions to control urban growth, the protection and acquisition of flood plain areas, the formulation of zoning and subdivision ordinances based on detailed studies of soils and geology, the possible use of quarry sites for water storage, the study of ground resources in the county and expansion of the State testing program to insure intense monitoring of quality of surface water resources. (Elfers-North Carolina) W74-03647

2020 PLAN, BOARD OF WATER SUPPLY/CITY AND COUNTY OF HONOLULU. Honolulu City and County Board of Water

Supply, Hawaii. For primary bibliographic entry see Field 04B. W74-03649

COMPREHENSIVE WATER SYSTEMS NEEDS PLAN, 1970-2000, ALLEGHENY COUNTY, PENNSYLVANIA.

Green Engineering Co., Sewickley, Pa.
For primary bibliographic entry see Field 03D.

THE WYOMING FRAMEWORK WATER PLAN, A SUMMARY.
Wyoming State Engineer's Office, Cheyenne.
Water Planning Program.
For primary bibliographic entry see Field 06B.
W74-03742

#### 6E. Water Law and Institutions

LEGAL FACTORS IN ECONOMETRIC MODELING OF LOCAL FLOODPLAIN MANAGEMENT DEVICES IN THE CONNECTIONS OF THE CONNECTION OF THE TICUT RIVER BASIN,
Massachusetts Univ., Amherst. Water Resources

Research Center. For primary bibliographic entry see Field 06F.

W74-03207

WATER LAW AND ITS RELATIONSHIP TO ENVIRONMENTAL QUALITY: A BIBLIOGRAPHY OF SOURCE MATERIAL, Colorado State Univ., Ft. Collins. Dept. of

Economics. For primary bibliographic entry see Field 05G. W74-03322

POLITICAL AND ENVIRONMENTAL AT-TITUDES OF VOTERS AND PUBLIC OFFI-CIALS RELATED TO ALTERNATIVE LEVELS OF WATER QUALITY AND CORRELATIVE LEVELS OF MANAGEMENT OF THE PENOB-SCOT RIVER.

Maine Univ., Orono. Dept. of Political Science. For primary bibliographic entry see Field 05G. W74-03323

TOWARD ENVIRONMENTAL SANITY, Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 05G. W74-03346

CORPORATE IMMUNITY FROM PROSECU-TION UNDER THE FEDERAL WATER POLLU-TION CONTROL ACT.

For primary bibliographic entry see Field 05G. W74-03376

THE DRAFT UNITED NATIONS CONVENTION ON THE INTERNATIONAL SEABED AREA -AMERICAN BAR ASSOCIATION POSITION American Bar Association, Washington, D.C. Natural Resources Law Section.

Natural Resources Law, Vol 4, No 1, p 60-72, January 1971. 12 p, 2 ref.

Descriptors: \*International law, \*Legal aspects, \*Outer continental shelf, Leases, Oceans, Governments, Governmental interrelations, Water quality standards, Treaties, Law of the sea, Exloitation

Identifiers: Coastal zone management.

This is a comprehensive analysis of the seabed convention which was submitted to the United Nations Seabed Committee in 1970 by the United States delegation. The proposal would amend the Outer Continental Shelf Lands Act by subjecting future leases to the provisions of any treaty to which the United States may become a party. The philosophy of the treaty is that the coastal states shall renounce or cede their rights under the convention, seaward of the 200 meter line, to the international regime, and receive in return some sort of a qualified title designated as a trusteeship. The significant point is that the source of the power to administer is no longer the Convention on the Continental Shelf or customary law as the Interna-tional Court of Justice declared it to be. Instead, the source of power of the coastal states would be

# Group 6E-Water Law and Institutions

the international regime, and the dominant law would be the treaty and its appendixes, which in-clude the full text of a universal seabed mining law (Mockler-Florida)

PRIVATE COMPENSATION FOR INJURIES SUSTAINED BY THE DISCHARGE OF OIL FROM VESSELS ON THE NAVIGABLE WATERS OF THE UNITED STATES: A SUR-

VEY, Port of Miami, Fla. For primary bibliographic entry see Field 05G. W74-03378

CALIFORNIA COASTAL ZONE CONSERVA-TION ACT, INTERIM PERMIT CONTROL,

GENERAL, University of Southern California, Los Angeles. For primary bibliographic entry see Field 06F. W74-03370

NOTE, ACCESS TO PUBLIC MUNICIPAL BEACHES: THE FORMULATION OF A COM-PREHENSIVE LEGAL APPROACH, R. S. Goldman.

Suffolk University Law Review, Vol VII, 936-972 (1973), 37 p. 2 tab, 185 ref.

Descriptors: \*Coasts, \*Beaches, \*Legal aspects, \*Public access, \*Constitutional law, Public rights, Adjacent landowners, Shores, Recreation, Seashores.

Identifiers: Public trust doctrine.

American society is presently facing increasing difficulties in providing adequate shoreline recreational facilities to meet the needs of the public at large. Difficulties are further intensified by exclusionary beach access fees charged by shorefront municipalities. In seeking to establish a public right of beach access, this paper reviews the public trust doctrine and the doctrine of irrevocable dedication. The scope of each doctrine is in-herently limited. The position adopted by the author is that the Constitution alones provides the broad applicability and substantive content necessary to support a successful attack upon discriminatory beach access fees. It is argued that the right of public access to shoreline recreational resources is a fundamental right for the purposes of the equal protection clause and that, therefore, beach access fees should be examined with extremely strict judicial scrutiny. The author concludes, however, that even under the 'traditional', less stringent equal protection standard, exclusionary policies practiced by shorefront mu-nicipalities fail to pass constitutional muster. (Sears-Florida) W74-03380

ENVIRONMENTAL LAW - WATER POLLU-THEORY IN SUIT BY FEDERAL GOVERN-MENT - UNITED STATES V. IRA S. BUSHEY AND SONS, INC., For primary bibliographic entry see Field 05G. W74-03381

COURSE OF ACTION UNDER FEDERAL COM-MON LAW FOR POLLUTION OF INTERSTATE

For primary bibliographic entry see Field 05G. W74-03382

INTERNATIONAL ENVIRONMENTAL BIBLIOGRAPHIES, SERIES I: LEGISLATIVE AND REGULATORY REPORTS. Environmental Protection Agency, Washington, D.C. Office of International Activities. For primary bibliographic entry see Field 05G. W74-03383

THE SUBSTANTIVE RIGHT TO ENVIRON-MENTAL QUALITY UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT.

R. Arnold. Environmental Law Reporter, Vol III, No 6, p 50028-50043, June 1973. 16 p, 102 ref.

Descriptors: \*United States, \*Legislation, \*Judicial decisions, \*Environmental effects, Balance of nature, Federal government, Governmental interrelations, Ecology.

Identifiers: \*National Environmental Policy Act.

Sovereign immunity.

Section 101 of the National Environmental Policy Section 101 of the National Environmental Policy Act (NEPA) is the nation's most widely applicable expression of environmental policy. The statute declares policy in broad terms and imposes procedural requirements on federal agencies in rather specific terms, and this article speculates as to whether NEPA also creates substantive rights enforceable in the courts. The language of the statute implies a desire to return to an earlier and better day when environmental quality existed and then to maintain that quality. The statute also in-dicates that the policies it contains are 'essential'. The nation's courts have taken a wide range of attitudes as to what rights NEPA creates, with some finding clear substantive provisions in the Act, and others saying that NEPA is 'only' a declaration of congressional policy and that it therefore cannot form the basis for an action in court. But congressional sional policy is the law. Although the Supre Court has not yet expressed itself clearly on the question, two of its opinions point the way, and the indication in both cases is that NEPA does create substantive rights. (McKnight-Florida) W74-03384

OPTIMIZING WATER USE: THE RETURN

FLOW ISSUE, Colorado Univ., Boulder. School of Law.

S. Williams.
University of Colorado Law Review, Vol 44, p 301-321, March 1973. 21 p, 2 chart, 83 ref.

Descriptors: \*Optimization, \*Return flow, Com-Descriptors: "Optimization, "Return flow, Colin-peting uses, Water allocation (Policy), Water dis-trubution (Applied), Water resources develop-ment, Industrial plants, Waste water treatment, "Colorado, "Water utilization, "Prior appropria-

Identifiers: Water rights (Non-reparians), Denver (Colo).

In a prior appropriation jurisdiction, the owner of a particular water right can transfer this right to another. Obviously, the way in which the new owner utilizes the right he acquires may have either adverse or beneficial effects on downstream appropriators. The present system fails to impose on the transfering parties the exact third party cost of the transfer; conversely it fails to make available to the transferring parties the value of the third party benefits. Thus, there is no assurance that all optimizing transfers will be permitted, nor is there any assurance that transfer with an adverse net impact will be stopped. Two recent case decisions by the Colorado Supreme Court exemplify the cur-rent attitude. In the first case, Metropolitan Denver Sewage Dist. No. 1 v. Farmers Reservoir and Irrigation Co., the City of Denver was allowed to transfer its sewage treatment operations to a new location over the protests of appropriators new location over the protests of appropriators downstream from the new location although the other appropriators would clearly be damaged. In the other case, the City of Denver was allowed to discharge quantities of water at a point on one river which allowed its buyer to use an equivalent amount in its plant on another river. (McKnight-W74-03385

STATEMENT FOR PUBLIC MEETINGS OF THE DEPARTMENT OF ARMY CORPS OF EN-GINEERS CONCERNING THE REFORMULA-

TION OF THE SIXES BRIDGE, DAM, AND LAKE PROJECT MARYLAND, AND THE VERONA DAM AND LAKE PROJECT, VIR-

GINIA,
Interstate Commission on the Potomac River
Basin, Washington, D.C.
For primary bibliographic entry see Field 05G.
W74-03386

RECYCLING ON THE LAND: AN ALTERNA-TIVE FOR WATER POLLUTION CONTROL Natural Resources Defense Council, Washington, D.C. Project on Clean Water. For primary bibliographic entry see Field 05D. W74-03387

WATER POLLUTION CONTROL HANDBOOK---A CITIZENS GUIDE TO THE FEDERAL WATER POLLUTION CONTROL ACT AMEND-MENTS OF 1972--VOLUME II, Natural Resources Defense Council, Washington, D.C. Project on Clean Water. For primary bibliographic entry see Field 05G. W74-03388

A BILL TO PROVIDE FOR THE CONVERSION OF DAM NUMBERED 3 ON THE BIG SANDY RIVER IN KENTUCKY.

House Bill 3477, 93rd Cong, 1st Sess (1973). 2 p.

Descriptors: \*Legislation, Federal government, \*Kentucky, \*West Virginia, Dam construction, Dams, Repairing, Appropriation, Engineering structures, Structures, Water supply, Local

This bill provides for the conversion of dam number 3 on the Big Sandy River in Kentucky to a fixed-type structure, and the repair of the same, in the interest of water supply and other benefits to local interests. The bill provides that the necessary work be provided by the Secretary of the Army, acting through the Chief of Engineers. The dam is located between Kentucky and West Virginia adjacent to Louisa, Kentucky. The work is to have no effect on the conditions that local interests shall own, operate, and maintain the structure and related properties as required by law. The bill authorizes and appropriates such funds as are necessary for the designated work. (Napolitano-Florida) W74-03389

A BILL TO AMEND THE FISH AND WILDLIFE COORDINATION ACT BY PROVIDING FOR REGULATION OF DUMPING IN UNITED STATES WATERS

House Bill 3101, 93d Cong, 1st Sess (1973). 5 p.

Descriptors: \*Legislation, \*Waste disposal, \*Water pollution, \*Ecology, \*United States, Sewage disposal, Sludge disposal, Waste water disposal, Ecosystems, Balance of nature, Environmental effects, Oceans, Wildlife, Legal aspects, Administration, Regulation, Water law, Legal review, Penalties (Legal). Identifiers: \*Fish and Wildlife Coordinating Act.

The proposed bill amends the Fish and wildlife Coordination Act so as to provide additional pro-tection to marine and wildlife ecology by providing for the orderly regulation of dumping in the ocean and other waters of the United States. The Administrator of the Environmental Protection Agency and the Secretary of the Interior are to establish standards which will apply to the deposit or discharge of all industrial wastes, sludge, spoil and all other harmful materials in United States waters. Such standards must require that any person, before depositing or discharging such materials into the waters of the United States, must present sufficient evidence to sustain a burden of

proof that such materials, in the location in which they are to be deposited will not endanger the natural environment and ecology. The district courts of the United States are given the jurisdiction to restrain violation under the proposed amendment. (Reed-Florida) W74-03390

#### A BILL TO ESTABLISH THE FRENCH PETE CREEK NATIONAL WOODLANDS RECREA-TION AREA.

House Bill 4373, 93rd Cong, 1st Sess (1973). 4 p.

Descriptors: \*Oregon, \*Legislation, \*United States, \*Recreation facilities, Recreation, Public lands, Campsites, Camping, Hunting, Sport fishing, Aesthetics, Lumbering, Administration, Permits, Planning, Regulation, Conservation, Mining, Federal reservation.
Identifiers: \*Timber harvesting.

The bill provides for the establishment of the French Pete Creek National Woodland Recreation Area in the Willamette National Forest in Oregon. The Secretary of Agriculture (Secretary) is to administer and develop the area. The Secretary, however, may not construct or permit the con-struction of public roads, permit the harvesting of timber except in specified circumstances, permit the use of any form of motorized transport within the areas or construct or permit the construction of structures or installations other than walk-in campsites, trail bridges, sanitary facilities and other necessary facilities to further the purpose for which the recreation area is intended. The lands within the recreation area, subject to valid existing rights, would be withdrawn from location. entry and patent under United States mining laws. The Secretary is to permit hunting, fishing and trapping in the area in accordance with applicable federal and state law. (Reed-Florida) W74-03391

#### A BILL TO AMEND THE PORTS AND WATER-WAYS SAFETY ACT OF 1972.

Senate Bill 80, 93rd Cong, 1st Sess (1973). 10 p.

Descriptors: "Legislation, "United States, "Navigable waters, "Powerplants, "Structures, Coasts, Fish, Shellfish, Wildlife, Resources, Recreation, Scenery, Conservation, Administration, Administrative Damages, Navigation,

This bill, initiated in the U.S. Senate, purports to amend the Ports and Waterways Act of 1972 to provide for authority to be placed in the National Oceanic and Atmospheric Administration (N.O.A.A.) for certification of the environmental soundness of the site selection, construction and operation of offshore artificial structures for ports and terminals, powerplants, airports, and other such facilities to be located in coastal waters. The purpose of such regulation is to prevent damage to coastal navigable waters, the coastal zone, and the resources therein, including, but not limited to, fish, shellfish, and wildlife, marine and coastal resources and recreational and scenic values. Certification is to be issued by the secretary of the department in which the N.O.A.A. is operating if it is determined that such artificial structure (defined in the act) does not pose an unreasonable threat to the integrity of the marine environment in which it is to be located and all possible precautions have been taken to minimize adverse impact. Specifically excluded from structures requiring certifica-tion are those used solely in exploring for, developing, or removing resources of the submerged lands. Guidelines are set forth to aid in establishing criteria for evaluating such structures. The penalty for failure to obtain certification is a fine of \$50,000-\$200,000. (Napolitano-Florida) CONCURRENT RESOLUTION EXPRESSING THE SENSE OF THE CONGRESS WITH RESPECT TO WATER POLLUTION. House Concurrent Resolution No 2, 93rd Cong, 1st Sess (January 3, 1973). 2 p.

Descriptors: "Water pollution control, "International law, "International waters, "United States, Water pollution sources, Chemicals, Chemical wastes, Oceans, Military aspects, Organizations, Pollution abatement. Treaties, Law of the sea.

This document contains a concurrent resolution by the House of Representatives with the Senate concurring indicating that it is the sense of the Congress that the pollution of waters all over the world is a matter of vital concern to all nations and should be dealt with as a matter of the highest priority. Moreover, it provides that it is the sense of the Congress that the President, acting through the U.S. delegation to the United Nations Conference on the Human Environment, should take such steps as may be necessary to propose an international agreement, or amendments to existing international agreements, as may be appropriate, providing for coordinated international activities to prohibit the disposal of munitions, chemicals, chemical munitions, military material, and any pollutants in territorial waters, contiguous zones, the deep seabed or any international waters, and otherwise to prevent the pollution of the waters of the world. (Mockler-Florida)

# A BILL TO ESTABLISH A NATIONAL FLOOD PLAIN POLICY.

PLAIN POLICY. House Bill 7454, 93d Cong, 1st Sess (May 3, 1973).

Descriptors: \*Flood plains, \*Floods, \*Flood protection, \*Legislation, \*United States, Water policy, Administrative agencies, Water law, Flood control, Flood damage, Natural resources, Legal aspects, Rivers, Streams, Flood forecasting, Water management (Applied), Nonstructural alternatives

The basic purposes of this bill are to establish a national flood plain policy, and to insure that preservation of flood plains and their unique natural functions and values shall be equally considered with other measures planned for the development and management of the Nation's surface and ground water. Encroachment upon flood plains by flood-damagable developments increases the hazards of floods and results in higher costs for effective flood control. It is thus the policy of Congress to preserve, protect, develop and restore the flood capacity and resources of the Nation's flood plain areas. All federal agencies involved in any developmental activity in or on flood plains of the United States are directed to give priority consideration to the protection and preservation of flood plain resources. (Glickman-Florida) W74-03394

A BILL TO IMPLEMENT THE INTERNA-TIONAL CONVENTION ON CIVIL LIABILITY FOR OIL POLLUTION DAMAGE AND THE IN-TERNATIONAL CONVENTION ON THE ESTABLISHMENT OF AN INTERNATIONAL FUND FOR COMPENSATION FOR OIL POLLU-TION DAMAGE. House Bill No 4394, 93d Cong, 1st Sess (February

20, 1973). 35 p.

Descriptors: \*International law, \*Oil pollution, \*Legal aspects, \*Legislation, \*United States, Water quality standards, Oceans, Oil wastes, Oil industry, Water pollution sources, Oil spills, Treaties, Foreign waters.

The proposed bill would apply exclusively to pollution damage caused on the territory, including the territorial sea, of the United States or of any foreign country which is party to the Liability Convention, and to preventive measures, wherever taken, to prevent or minimize such damage. Nothing in the bill prejudices any right of recourse of the owner against third parties. Moreover, when oil has escaped or has been discharged from two or more ships, resulting in pollution damage, the owners of all the ships concerned shall be jointly and severally liable for all such damage which is not reasonably separable. In addition, any claim for compensation for pollution damage may be brought directly against the guarantor of the owner's liability for pollution damage and, in such a case, the defendant may, irrespective of the actual fault or privity of the owner, avail himself of the limits of liability prescribed in the bill. (Mockler-Florida)

# A BILL AUTHORIZING THE CONSTRUCTION, REPAIR, AND PRESERVATION OF CERTAIN PUBLIC WORKS ON RIVERS AND HARBORS FOR NAVIGATION, FLOOD CONTROL, AND OTHER PURPOSES.

Senate Bill no 603, 93d Cong, 1st Sess (January 29, 1973). 9 p.

Descriptors: \*Legislation, \*United States, \*Flood control, \*Flood protection, Recreation, Land use, Comprehensive planning, Navigation, Water quantity management, Administration, Legal aspects, Beneficial use, Water resources development

The various projects covered by this bill include the proposal for hurricane flood protection at Virginia Beach, Virginia; the project for flood protection on Bowie Creek, Mississippi; the project for Camp Ground Lake on Beech Fork in the Salt River Basin, Kentucky; the flood control project on Fall creek, Indiana; the project for flood control on Center Creek near Joplin, Missouri; the West Tennessee tributaries feature, Mississippi River and tributaries project in Tennessee; the Cache River Basin feature, Mississippi River and tributaries project in Arkansas; the project for flood control and other purposes on the Blanco River at Clopton Crossing, Texas; and the project for flood control and other purposes on the Blanco River at Clopton Crossing, Texas; and the project for flood control on the South Umpqua River in Oregon. The legislation authorizes comprehensive review of the use of these lands for recreation and fish and wildlife purposes and solicits recommendations as to those measures which should be undertaken to insure the best use of such lands. (Mockler-Florida) W74.0336

#### AN ACT TO REGULATE THE TRANSPORTA-TION FOR DUMPING, AND THE DUMPING OF MATERIAL INTO OCEAN WATER, AND FOR OTHER PURPOSES.

Public Law 92-532, 92nd Cong, Hr 9727, October

Descriptors: \*Waste disposal, \*Environmental effects, \*Sludge disposal, \*Legislation, \*United States, Radioactive waste disposal, Waste water disposal, Sewerage, Public health, Wildlife, Marine biology, Ecosystems, Ocean waters, Water pollution, Environmental control, Permits, Protection, Legislation.
Identifiers: Environmental effects.

The Marine Protection, Research and Sanctuaries Act of 1972 was set up to regulate the transportation for dumping and the dumping of material into ocean waters. Congress has declared that it is the United States policy to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. To prohibit such acts, Environmental Protection Agency permits must be obtained to authorize transportation and dumping

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into ocean waters any of the polluting wastes designated. The need, effect on health, welfare, shoreline, wildlife, and marine life, and alternatives shall be considered in granting such a permit. The Act makes adequate provisions for regulation, enforcement, liabilities and penalties to carry out the Act's overall purpose. (Daniels-Florida) W74-03399

#### INTERSTATE DRAINS.

Ind Ann Stat secs 27-2601 thru 27-2606 (1970).

Descriptors: \*Indiana, \*Statutes, Legal aspects, Jurisdiction, Water quality control, Water resources development, Local govern-ments, Water law, Water policy, Governmental interrelations, Drainage districts.

These are the Indiana Annotated Statutes dealing with interstate drains. The statutes provide that whenever a petition to construct or reconstruct a drain is filed pursuant to this Act, or when preceedings are initiated in an adjoining state to construct or reconstruct a drain, and when the proposed improvement will affect lands in the state and also in an adjoining state, the board shall have the authority to join with the proper officials in a joint effort to construct or reconstruct such drain. Moreover, upon receiving final reports of proposed improvements, the drainage board of Indiana shall assess the benefits and damages to each tract of land affected in the state, and in so doing the board shall be governed by the provisions of this Act as applied to a drain located sole-ly within the state. Whenever the improvement is finally and conclusively established in two or more states and when funds are available, interstate boards shall meet and let work contracts. (Mockler-Florida) W74-03400

MAINTENANCE OF DAMS, LEVEES AND FLOOD CONTROL WORKS. Ind Ann Stat secs 27-1801 thru 27-1808 (1970).

Descriptors: \*Indiana, \*Legislation, \*Dams, \*Flood control, \*Levees, Engineering structures, Flood prevention, Dikes, River regulation, Shore protection, Retaining walls, Earth works, Administration

The statutes provide that the Indiana flood control and water resources commission shall, on behalf of the state, have jurisdiction and supervision over the state of the maintenance and repair of dams, levees, dikes, flood walls, and appurtenant works in, on, or along the rivers, streams, and lakes of the state and shall exercise care to see that such structures are maintained in a good and sufficient state of repair and operating condition to fully perform their intended purpose. The commission is authorized to adopt standards and regulations as may be necessary for the purposes of the act. Moreover, the commission may in its discretion vary the standards for maintenance and operation, giving due consideration to the type and location of the structure, the hazards to which it is or may be exposed and the peril to life or property in the event of the structure's failure to perform its function. The commission is also authorized to make engineering inspections of all dams, levees, dikes, and floodwalls at least once a year. (Mockler-Florida) W74-03401

HOWE V. DI PIERRO MANUFACTURING CO. INC. (APPEAL BY DEFENDANTS FROM AN ORDER ENJOINING THEM FROM FLOODING PLAINTIFF'S PROPERTY). 294 N.E. 2d 495-498 (Mass. App. 1973).

Descriptors: \*Massachusetts. \*Riparian rights. \*Natural flow doctrine, \*Alteration of flow, Riparian waters, Reasonable use, Surface drainage, Flooding, Water policy, Damages, Legal aspects, Judicial decisions. Identifiers: Injunctive relief.

The plaintiffs, owners of real property, brought a suit in equity praying for injunctive and general relief from defendants, neighboring land owners. Plaintiffs contended that the combined effect of actions of defendants in filling in a pond and a swamp and enclosing a natural watercourse within a culvert caused permanent injury to their proper-ty. Defendants built a parking lot where the pond and swamp had been and installed a drainage system which collected surface waters and emptied them into the culvert unreasonably causing the flooding of the plaintiffs' property. Such injury would be permanent unless defendants were to somehow rectify the condition. The court held that although the source of water introduced by riparian owners into a natural stream is a manufacturing process rather than a collection of surface waters the application of general rule concerning rights of riparian owners is not changed. The plaintiff was granted injunctive relief designed to restore his property to the condition in which it would have been if it had never been injured, but was not given damages for diminution in value. (Daniels-Florida) W74-03402

CITY OF MIDWAY V. MIDWAY NURSING AND CONVALESCENT CENTER, INC. (SUIT BY CITY TO ENJOIN CHURCH FROM FURNISHING WATER TO NURSING HOME AND ENJOIN NURSING HOME FROM BECKLUING WATER BROWN OFTHER DEEDS RECEIVING WATER FROM OTHER DEFEN-DANTS IN COMPETITION WITH CITY).

195 S.E. 2d 452-455 (Ga. 1973).

Descriptors: \*Georgia, \*Public utilities, \*Water water users, "Water distribution (Applied), Water supply, Local governments, Pulbic health, Cities, Legal aspects, Judicial decisions, Legislation. Identifiers: Injunctive relief.

The City of Midway (City) as plaintiff brought action against the Midway Nursing and Convalescent Center asking that the defendant be enjoined from drilling its own water well, and requesting that the defendant be required to accept water from the city system. The City maintained it was acting under its police powers and as a matter of public policy to protect public health, safety and morals and that the defendant's action was designed to circumvent this policy. The court conceded that there is valid authority for the proposition that a municipal corporation may compel connection to a public drain or sewer in the exercise of its police power, but refused to accept the City's contention that this also extends to water supply. The court felt that the injunctive relief so would lie only if the City were able to establish that some reasonable basis existed for protecting the health and welfare of the citizens manner. In denying relief, the court found that the City had been without authority when it passed an ordinance requiring that all residences and businesses were required to connect to the city system. (McKnight-Florida) W74-03403

TAYLOR V. ASKEW (PROCEEDING TO CON-DEMN A CARTWAY OVER LANDS OF RESPONDENTS TO CONNECT A TRACT OF TIMBLERLAND OWNED BY PETITIONERS).

195 S E 2d 316-319 (Ct App N C 1973).

Descriptors: \*North Carolina, \*Drainage districts, \*Eminent domain, \*Canals, Real property, Public access, Judicial decisions, Legislation, Legal aspects, Surface drainage.

Petitioners brought suit under a North Carolina statute to condemn a cartway over the lands of respondents in order to connect a tract of timberland owned by the petitioners with a state highway. Respondents admitted that no public roads led to the petitioners' land, but denied that petitioners lacked other adequate ways of ingress and egress. The court noted that the statute which authorizes in certain cases the condemnation of a cartway for the benefit of one landowner over the lands of his neighbor is in derogation of the rights of the owner of the land over which the cartway is to be established and therefore must be strictly construed. Thus, a petitioner is not entiteld to condemn a cartway if he presently has reasonable ac-cess to a public road. The court found that the petitioners did have adequate ingress and egress to their property in that they could build a road along the drainage district spoil bank. The court stated that the drainage district did have authority to allow construction of this road because the road would facilitate maintenance of the district's drainage canal. (McKnight-Florida)

FINISH ALLATOONA'S INTERSTATE RIGHT, INC. V. VOLPE (SUIT TO ENJOIN CONSTRUC TION OF LAST SEGMENT OF HIGHWAY 1-75 ACROSS PORTION OF PUBLICLY OWNED LAKE). 355 F Supp 933-938 (N D Ga 1973).

Descriptors: \*Public lands, \*Highway relocation, \*Highway effects, Clean Air Act, Environmental effects, Lakes, \*Georgia, Judicial decisions, Ecology, Legal aspects. Identifiers: Expressways, Location, Public land

protection, Transportation.

Plaintiff corporation filed suit to enjoin the construction of Interstate Highway 75 in the vicinity of a nearby lake which is operated as a flood control, hydroelectric and recreational facility. The state submitted a proposed route across the lake. The state prior to approval of the route prepared a comprehensive environmental impact statement. The defendant, Secretary of Transportation, likewise prepared a detailed report treating various alternatives for the location of 1-75. The Secretary in that report concluded that there was no prudent alternative to the proposed route. The plaintiff submitted an alternative which it contended would be more environmentally sound. Plaintiff based its action on the contention that defendant conspired to spend federal funds to construct 1-75 in violation of federal law which required non-approval of a transportation project which requires use of publicly owned land from a public park, recreational area or wildlife refuge unless there is no feasible alternative. The court held that the district court made no clear error of judgment in that all necessary procedural steps had been followed and also found that there was no violation of the Clean Air Act. The construction was therefore allowed to commence. (Daniels-Florida) W74-03405

PEOPLE OF SAIPAN V. UNITED STATES DEPT. OF INTERIOR (ACTION TO ENJOIN CONSTRUCTION OF HOTEL ON PUBLIC LAND UNTIL ENVIRONMENTAL IMPACT OF HOTEL HAS BEEN EVALUATED).

356 F Supp 645-660 (D Hawaii, 1973). 16 p.

Descriptors: \*Governmental interrelations, \*Environmental effects, \*Ecology, \*Pacific Ocean, Federal government, United States, Adjudication procedure, Legislation, Atolls, Public rights, Legal aspects, Leases, Administrative agencies, Governments, Reefs.

Identifiers: \*National Environmental Policy Act, \*Environmental impact statement, \*Injunctive re lief, \*Sovereign immunity, \*Standing (Legal).

Plaintiff sought to enjoin construction of a hotel on public land leased on Saipan Island until environmental impact survey had been made. Local people felt they would be deprived of the use of the beach nearby and the project would strain over-burdened utilities and damage the ocean and reef. The High Commissioner of the Territory approved the lease. Plaintiff contended the National Environmental Policy Act (N.E.P.A.) was applicable to Trusteeship officials and noncompliance called for review by the court under the Administrative Processing Proc trative Procedure Act (A.P.A.). Defendant Commissioner and developer argued the inapplicability of N.E.P.A. and the plaintiff lacked standing. The court held N.E.P.A. applicable to U.S. governmental agency activity in a Trusteeship but not to the Trusteeship government which is exempt from review under the A.P.A. Non-resident aliens have standing to sue under N.E.P.A. when they allege an adverse effect to their use of a public area. Approval of the lease by the Trusteeship government was not a federal action but was a major action within the meaning of N.E.P.A. However, plaintiff's suit was dismissed due to the inability of the court to review the actions of the trust govern-ment. (Wehby-Florida) W74-03406

UNITED STATES V. PENNSYLVANIA INDUSTRIAL CHEMICAL CORP. CORPORATION WAS CONVICTED OF DISCHARGING REFUSE INTO NAVIGABLE WATERS IN VIOLATION OF RIVERS AND HARBORS ACT OF 1899, AND IT APPEALED).

461 F 2d 469 (1973), 14 p.

Descriptors: \*Pennsylvania, \*Rivers and Harbors Act, \*Permits, \*Navigable rivers, \*Liquid wastes, Legal aspects, Navigable waters, Wastes, Navigation, Aqueous solutions, Suspension, Suspended bodies, Industrial wastes, Chemical industry. Identifiers: \*Monongahela River, Navigation obstructions.

Defendant corporation was convicted in the District Court of discharging refuse into the Monongahela River without a permit. The Third Circuit reversed, holding that a defense would exist if defendant could prove that no permit program existed at the time of discharges in question or if a permit program existed but a Corps of Engineers affirmatively misled defendant into believing that a permit was not necessary in its situation. Defendant's conduct was alleged to be a violation of the Rivers and Harbors Act of 1899 (Act). The court stated that the Act applies to all discharge of refuse into navigable waters and not merely that which may impede navigation. It is no defense that solids discharged were in solution rather than suspension nor is it a defense that defendant complied with water quality standards of later enactments. Liquid industrial waste flowing through de fendants own pipes into navigable waters was not within exception for refuse flowing from streets and sewers in a liquid state. It may have violated due process to hold defendant criminally responsible for activities which could not reasonably have been anticipated to be illegal based on 70 years of consistent government interpretation of the Act as prohibiting only discharges which impeded navigation. (Sears-Florida) W74-03407

CAMP V. MILAM (ACTION TO FORCE NON-LAKE-FRONT OWNER TO REMOVE BOATHOUSE FROM LAKE SHORE).

277 So 2d 95-101 (Ala 1973), 7 p.

Descriptors: \*Alabama, \*Artificial lakes, \*Easements, \*Lake shores, Dams, Permits, Recreation, Judicial decisions, Public access, Real property, Legal aspects. Identifiers: \*Iniunctive relief. \*Licenses. Plaintiff had entered an agreement with defendant some time in the past by which defendant would construct a dam on plaintiffs' artificial lake in return for a parcel of land and the right to use the lake. The defendant did construct the dam and the plaintiff conveyed to the defendant a non-lakefront tract of land on which the defendant constructed a home. The defendant later constructed a boathouse on land owned by the plaintiff, but with the plaintiffs' knowledge and consent. When rela-tions between the plaintiff and defendant became strained, the plaintiffs brought suit, asking the court to force the defendant to remove the boathouse and also requesting the court to declare that the plaintiffs had sole and exclusive rights to the use of the lake and that the defendant had no interest therein. The court rejected both the argument of the plaintiff that a mere revocable lice had been granted and the contention of the defendant that an easement had been created, finding instead that the defendant possessed an irrevocable license for the reasonable use of the lake commensurate with its size and nature and as originally contemplated and intended by the parties. (McKnight-Florida) W74-03408

#### FLOOD CONTROL.

N J Stat Ann secs 58:16A-50 to 58:16A-66 (1972).

Descriptors: \*Flood protection, \*Flood data, \*Flood plain zoning, \*Flood plains, Legislation, State government, Governmental interrelations. Identifiers: Administrative regulations, Notice.

The Division of Water Resources is empowered to mark flood hazard areas, and the Department of Environmental Protection (Department) is authorized to adopt land use regulations for the floodway and to coordinate effectively the development, dissemination, and use of information on floods and flood damages that may be available. The Department is authorized to adopt, amend, and repeal rules concerning the development and use of land in any designated floodway which shall be designed to preserve its flood carrying capacity and to minimize the threat to the public safety, health and general welfare. Within welve months after the promulgation of standards by the Department, affected municipalities shall adopt rules and regulations which at least conform to the standards promulgated by the Department. No rules or regulations adopted by the Department are effective until the Department has conducted public hearings, and rules promulgated do not apply to the extent that lands affected thereby are regulated pursuant to the Wetlands Act of 1970. Persons violating the rules adopted are subject to fine, and if the violation is of a continuing nature, each day constit (McKnight-Florida) constitutes a separate offense. W74-03410

# SEWERAGE DISTRICTS AND SEWERAGE DISTRICT BOARDS.

N J Stat Ann secs 58:12-2 through 58:12-4.1 (1972).

Descriptors: \*Sewage districts, \*New Jersey, \*Waste water (Pollution), \*Water pollution treatment, \*Sewage treatment, Legislation, Sewage effluents, Sewage systems, Wastes, State, Governments.

Identifiers: \*Administrative regulations, Injunctive relief, Notice.

The State Department of Environmental Protection (Department) is charged with investigating the various methods of sewage disposal as to be able to make recommendations in regard thereto, requiring necessary alterations of sewage treatment works, investigating complaints of pollution of the waters of the state and inspecting the waters of the state. If the Department finds that any of the waters are being polluted, it shall notify the party

polluting such waters in writing and order such pollution to cease. Any person aggrieved by such an order is entitled to a hearing. Plans for any new sewage treatment facility shall be submitted to the Department for approval and in considering such plans the department shall give due consideration to community development of comprehensive regional sewage facilities in order to be assured insofar as is practicable that all proposed sewage works shall conform to reasonably contemplated development of comprehensive sewage facilities. Violations are subject to a fine, with each day of continuing violation constituting a separate and distinct violation. (McKnight-Florida) W74-03411

# STATE ASSISTANCE FOR LOCAL GOVERNMENT.

N J Stat Ann secs 26:2E-1 to 26:2E-11 (1972).

Descriptors: \*New Jersey, \*Sewerage, \*Sewage disposal, Domestic wastes, Legislation, Government finance, Research and development, Water resources development, State governments, Planning. Identifiers: Administrative regulation.

The purpose of the statute is to encourage and support the promotion, planning, development and construction of public sanitary sewerage facilities, including sewerage collection, transmission, treat-ment, and disposal works on a regional basis. The State Commissioner of Health (Commissioner) may make grants to local government units for the preparation of feasibility studies on the future collection, treatment and disposal of sewage in such unit, or on the extension of existing facilities now operated by the unit. The Commissioner may make loans to any local government unit for the preparation of engineering plans for the construction of a new or the expansion of an existing tion of a new or the expansion of an existing sewerage facility. For the purpose of funding these loans, a State Sewerage Facilities Loan Fund is established which shall be administered by the State Treasurer. The Commissioner is also authorized to make grants to municipalities to authorized to make grants to municipalities to assist in the construction of water pollution control projects. A Clean Water Council is created, and its duties include advising the Commissioner as to matters relating to the preservation and im-provement of water and holding public hearings in regard to existing water pollution control statutes. (McKnight-Florida) W74-03412

#### WATER POWER.

N Y Sess Laws, Ch 664, Sess 15-1701 through 15-1751 (McKinney 1972).

Descriptors: \*Water control, \*Permits, Navigable waters, Water works, Eminent domain, Water flow, Ownership, Legislation, New York, State jurisdiction, Legal aspects.

Where any person takes, diverts or otherwise uses the waters of the state over which the state has the proprietary ownership of the flow, such water shall remain subject to the power and control of the state for the purposes of regulating, licensing, controlling and terminating the use and disposition of the same. This title makes provisions for licensing procedures with conditions and provides for the protection of navigable waters. There are also provisions for rental charges, maintenance of project works, eminent domain proceedings, contract extension, and revocation of licenses. The state reserves the right to amend and appeal the licenses and legislation. (Daniels-Florida)

SOAP AND DETERGENT ASSOCIATION V. CITY OF CHICAGO (DECLARATORY ACTION

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TO SET ASIDE CITY ORDINANCE PROHIBIT-ING SALE OF PHOSPHATE DETERGENTS). 357 F Supp 44-51, (N D III, E D 1973). 8 p.

Descriptors: \*Environmental control. \*Detergents, \*Water pollution, \*Illinois, Legislation, Ordinances, Water policy, Interstate, Phosphates, Water pollution sources, Water supply, Water-ways, Regulation, Judicial decisions, Public ealth, Municipal wastes.

Identifiers: City ordinances, Interstate commerce.

Plaintiffs, detergent manufacturers, sought to set aside a city ordinance making it a criminal offense to sell detergents containing phosphorus within the city. The ordinance was adopted by the city on the recommendation of its Committee on Environ-mental Control after public hearings were held. Plaintiffs contended that such detergents were useful and harmless and thus the city's ordinance was an unreasonable and unjustifiable interference with their distribution and sale of these products in interstate commerce. The city contended that the ordinance was justified in order to protect the local waterways and the city's water supply. It contended that phosphates accelerate the natural eutrophication of the water and are unreasonably expensive to remove by sewage treatment. The court held that local governments do have right to enact laws for the protection of the public, but must show sufficient necessity for the health, safety, or welfare of the local citizenry. The defendant city failed to demonstrate such necessity and thus the ordinance constituted an unjustifiable interference with interstate commerce. (Daniels-Florida) W74-03414

RUCKER V. WILLIS (CLASS ACTION SEEKING TO ENJOIN CONSTRUCTION OF PROPOSED MARINA AND PIERS).

358 F Supp 425-430 (ED NC 1973). 6 p.

Descriptors: \*North Carolina. \*Environmental ef-Descriptors: "North Carolina, "Environmental effects, "Construction, Water permits, Environmental control, Water quality, Judicial decisions, Governmental interrelations, Engineering structures, Shore protection, Marinas, Recreation

Identifiers: Environmental Impact Statements.

Plaintiff, private individual, sought to bring a class action to enjoin defendant federal agencies and private landowner from constructing a proposed marina and piers in the surrounding ocean and sound. Private defendant, prior to construction, filed for a permit with the United States Army Corps of Engineers. Public notice of application was made and copies were furnished to federal and state agencies, environmental organizations, and other interested persons. The Environmental Protection Agency, which is responsible for water quality, did not respond to the public notice, and thus it was decided that no environmental impact statement was needed. The essence of private plaintiff's claims are (1) that federal defendant failed to file impact statement as required, and (2) that the permits issued were arbitrary exercises of governmental authority, therefore the permits were issued illegally. The court found that the decision of the district engineer in not requiring the environmental impact statement was not arbitrary or capricious when his decision was based on fact that no federal or state agency certified that such permit would have adverse environmental effects. Also, the case is not a major federal action affecting the quality of the human environment. Thus no impact statement was required and the project could proceed. (Daniels-Florida) W74-03415

U.S. V. JOSEPH G. MORETTI, INC. (LAND FILLS DEEMED 'STRUCTURES' UNDER

RIVERS AND HARBORS ACT OF 1899).

478 F 2d 418-433 (5th Cir 1973), 16 p.

Descriptors: \*Navigable waters, \*Rivers and Harbors Act, \*Structures, \*Land fills, \*Environmental effects, Land development, Land use, Environmental control Permits. Obstruction to flow.

The plaintiff, U.S. Government, brought an action for injunctive relief restraining defendant land developers from dredge and fill work in the Florida Bay under the Rivers and Harbors Act of 1899 (Act) which forbids the creation of obstructions in, or alterations of the features of the navigable waters of the United States without permission of the Secretary of the Army. Defenda after filing for an after-the-fact permit to legalize work already done, began new construction before approval or denial of such permit. Defendant imed that the Act only grants the district court authority to cause the removal of 'structures' from 'navigable' waters and that his land fill was not a 'structure.' The court of appeals held that the construction of land fills in Florida Bay constituted an obstruction of navigable waters and that such fills 'structures' subject to removal pursuant to mandatory injunction for failure to secure authorization. The court further held that the issuance of a mandatory injunction requiring extensive restoration was within the District court's power pending the final decision and processing of defendant's application for an after-the-fact permit. (Daniels-Florida) W74-03416

KINGS COUNTY ECONOMIC COMMUNITY DEVELOPMENT ASSOCIATION V. HARDIN (PAYMENT OF FARM SUBSIDIES DO NOT REQUIRE NEPA APPROVAL). 478 F 2d 478-481 (9th Cir 1973). 4 p.

Descriptors: \*Water pollution, \*Impaired water quality, \*Agricultural chemicals, \*Public health, Government supports, California, Federal Water Pollution Control Act, Pollution abatement, Fertilizer, Nitrates, Judicial decisions, Legislation, Pest control, Water wells.

Identifiers: National Environmental Protection

Plaintiffs, an unincorporated association of low in-come persons and individuals representing a class of hand-harvest farm workers brought suit against federal officials to require them to take action in control of water pollution caused by agricultural water users. The plaintiff's members could not afford to purchase bottled water and filter and accordingly were forced to use high-nitrate water from wells in the vicinity of Delano, California.
The plaintiff's action was based on the National
Environmental Policy Act (NEPA) and the Federal Water Pollution Act and was aimed at denying farm subsidies and loans to users of pesticides and fertilizers. The Court of Appeals af-firmed the denial of relief in that the relief sought was directed at private rather than public action. The court refused to find the payment of farm subsidies a major federal action significantly affecting the quality of the human environment, which is the prerequisite for the application of NEPA. The court based this on the fact that under the Agricultural act of 1970 the recipient is free to use the money in any way he sees fit and the fact that it was put to a use affecting the environment cannot convert that private use into federal action.
(Gragg-Florida)
W74-03417

WILD, SCENIC AND RECREATIONAL RIVERS

N Y Sess Laws, Ch 869, secs 429-K through 429-V, (McKinney 1972).

Descriptors: \*New York, \*Recreation, \*Water utilization, "Legislation, "Social aspects, Conservation, Water resources development, Scenery, Wild rivers, Water policy protection, Rivers.

The State of New York has established a state wild, scenic and recreational rivers system. Certain selected rivers and their immediate environs will be protected for the benefit and enjoyment of present and future generations. The rivers to be included in the system are divided into three classes with differing criteria for inclusion and differing management objectives. Wild rivers or sections of rivers are those that are free of diversions and impoundments, and which are inaccessible to the general public except by water, foot or horse trail. Scenic rivers or sections of rivers are those that are free of diversions or impoundments except for log dams, with limited road access and with river areas largely primitive and largely undeveloped. Recreational rivers are those that are readily ac-Recreational rivers are those that are readily accessible by road or railroad and that may have development in their river area. The Act goes on to enumerate certain rivers to be included in the system and to provide for procedures to add rivers to the system. (Gragg-Florida) W74-03418

AMERICAN FALLS DAM, UPPER SNAKE RIVER PROJECT, IDAHO. Hearing-Subcomm on Water and Power Resources--Comm on Interior and Insular Affairs-

-United States Senate, 93d Cong, 1st Sess, May 10, 1973. 206 p, 2 photo, 1 chart.

Descriptors: \*Legislation, \*Dam construction, \*Idaho, \*Structural behavior, \*Federal Reclamation Law, Dam failure, Interstate river, Hydraulics, Dams, Water supply, Reservoirs, Safety factors, Construction materials, Structural stability. Identifiers: Congressional hearings.

This hearing before the Subcommittee on Water and Power Resources of the Committee on Interi-or and Insular Affairs of the United States Senate was for the purpose of taking testimony on two bills which would authorize the construction of a replacement for the existing American Falls Dam.
This dam is a component of the Minidoka Reclamation project in southeastern Idaho. Due to structural deterioration, the dam fails to meet current safety standards and severe restrictions have had to be imposed upon the amount of water which can be stored in the reservoir. The hearing involved two alternative bills, one which involved two alternative bills, one which authorizes the Secretary of the Interior to construct a replacement dam under the reclamation program and a second bill that provides for a plan in which the water users would finance and con-struct a replacement dam without federal assistance. The subcommittee heard statements from various members of the Idaho Congressional delegation, residents of Idaho, representatives of power companies and numerous other interests. (Gragg-Florida) W74-03419

THE NATION'S ESTUARIES: SAN FRANCISCO BAY AND DELTA, CALIFORNIA. For primary bibliographic entry see Field 05G. W74-03420

CITY OF CHAMPAIGN V. ENVIRONMENTAL PROTECTION AGENCY (ADMINISTRATIVE PROCEEDING FOR ALLEGED POLLUTION AGAINST CITY, UNIVERSITY BOARD OF TRUSTEES AND OTHERS).

299 N.E.2d 28-32 (Ill. App. Ct. 1973). 5 p.

Descriptors: \*Water pollution sources, \*Judicial decisions, \*Water pollution control, \*Pollution abatement, \*Municipal wastes, \*Illinois, Water quality, Discharge, Wastes, Powerplants, Univer-

Identifiers: Environmental Protection Agency.

A procedural dispute involved an order of the Illinois Pollution Control Board (Board) which was
originated by the Environmental Protection Agency against the cities of Champaign and Urbana.
The city allowed water pollution on certain dates
by permitting contaminants to enter Boneyard
Creek. The City filed a third party complaint
against the University of Illinois charging it with
contributing to the pollution through the operation
of a power plant. The Board found that a pollutional discharge had occurred and ordered both the
City and the University to file a report containing a
program detailing the corrective measures to be
taken to stop the pollution. The court vacated the
order as it applied to the University in that it was
not proved that it was responsible for any pollution. The order as to the City was vacated and remanded. The dissent would have dismissed for
want of a final appealable order. Its contention
was that the Board's order was not final. (GraggFlorida)
W74-03421

CHARLES V. DIAMOND (EXTENT TO WHICH POLICE POWERS MAY BE USED TO DISAD-VANTAGE INTERESTS IN PRIVATE PROPER-TY)

345 N.Y.S.2d 764-768 (App. Ct. N.Y. 1973). 5 p.

Descriptors: \*Water pollution, \*Water pollution control, \*Municipal wastes, \*New York, Judicial decisions, Sewage, Sewage treatment, Water pollution sources, Legal aspects, Administration, Local governments, Constitutional law. Identifiers: Injunctive relief.

The petitioner, a landowner, wished to construct an apartment building. He challenged the right of the New York State Department of Environmental Conservation (Department) to enjoin the new extensions of the Village of Camillus' sewer system. The Department issued its non-extension order in 1966 because the municipal sewage outlet discharged pollutants into a creek. The order also required that the Village take immediate steps to plan construction of a treatment facility. The Village had taken no steps to construct treatment facilities. The petitioner alleged that the actions of the respondent resulted in the unconstitutional confiscation of his property. The court was swayed by the fact that the Village had taken no action nor had the Department attempted to force compliance. It found that this exercise of the police power went too far and resulted in a taking. (Gragg-Florida)

COMMONWEALTH, MARINE RESOURCES
COMMISSION V. FORBES (SUIT BY STATE
ALLEGING DEFENDANTS, WITHOUT
AUTHORITY, HAD DEPOSITED FILL UPON
STATE OWNED SUBAQUEOUS BEDS OF
RIVER; PRAYING FOR INJUNCTIVE RELIEF).

197 S.E.2d 195-200 (Va. 1973). 6 p.

Descriptors: \*Legislation, \*Riparian rights, \*Riparian land, \*Virginia, Judicial decisions, Permits, Landfill, Beds, Legal aspects, Water rights, Water law, Ownership of beds, Severance. Identifiers: Subaqueous beds, Injunctive relief.

The Commonwealth of Virginia was denied an injunction by which it sought to stop defendants from depositing fill upon state owned subaqueous beds. The Commonwealth appealed. The defendants were depositing fill which had been severed from the appurtenant highland in accordance with their riparian rights. Such severance and alienation as separate property is allowed in Virginia. The problem centered on the interpretation of a state statute which creates a right that did not exist at common law, viz., the right to fill subaqueous beds by riparian owners. The Supreme Court of Virginia said that the statute only conferred the new

right to fill upon the owner of highland with riparian rights appurtenant thereto. The court, however, recognized that if the same party owned the severed rights and the appurtenant land as two separate pieces of property that they would merge to revive the fee simple absolute. The court remanded for further factual determination. (Gragg-Florida)
W74-03423

CAMPAIGN CLEAN WATER, INC. V. RUCKELSHAUS, (ACTION BROUGHT AGAINST ADMINISTRATOR OF ENVIRONMENTAL PROTECTION AGENCY CHALLENGING IMPOUNDMENT WITH RESPECT TO FUNDS AUTHORIZED TO BE APPROPRIATED BY CONGRESS).

361 F. Supp. 689-701 (E.D.Va. 1973), 13 p.

Descriptors: \*Virginia, \*Judicial decisions, \*Water Quality Act, \*Federal Water Pollution Control Act, Wastes, Waste treatment, Water law, Legislation, Water pollution, Legal aspects, Water pollution control, Water pollution effects, Water policy, Governments.

Identifiers: Sovereign immunity, Environmental Protection Agency, Impoundment.

Plaintiff, an environmental group, challenged the Administrator of the Environmental Agency (EPA) for impoundment of funds appropriated by Congress under the Water Pollution Control Act (Act). The plaintiff alleged injury as a result of waste contamination in Virginia's waters and that such contamination is directly attributable to inadequacy of waste treatment plants. These plants were to be replaced or improved with federal money which has been impounded. The case was highly procedural in nature. The court was faced with the questions of standing, mootness, sovereign immunity, and whether a justiciable case or controversy was present. Having answered these questions affirmatively the court then examined the merits of the complaint. After a review of the legislative history of the Act, the court found that although the Act provided for discretion, such discretion only applied to the actual expenditure and not to the allotment. The court gave the EPA ten days to conform the administration of the program to this decision. (Gragg-Florida) W74-03424

CAPE HENRY BIRD CLUB V. LAIRD (ACTION FOR INJUNCTIVE AND DECLARATORY RELIEF, ON ENVIRONMENTAL GROUNDS, AGAINST FEDERAL DAM PROJECT).

359 F. Supp. 404-423 (W.D. Va. 1973). 20 p.

Descriptors: \*Dams, \*Flood control, \*Water quality control, United States, Legislation, Project, Flood Control Act, Environmental effects, Legal aspects, Judicial decisions.

This action sought injunctive and declaratory relief on environmental grounds against a federal dam project. The principal purposes of the dam are flood and water quality control. The plaintiff environmentalists alleged that the federal defendants failed to comply with federal statutes and therefore their actions were illegal because the decision was arbitrary and capricious. Defendants asserted that they fully complied with all the applicable laws especially those concerning adequate environmental protection. The court held that, with respect to the dam project authorized by the Flood Control Act, the National Environmental Protection Act rather than itself being a deciding factor, is to be used only to enable the court to determine whether all environmental factors have been given full and adequate consideration. The court further stated that the project could not be halted simply because costs involved might exceed benefits derived. The injunction was therefore denied. (Daniels-Florida)

W74-03425

U.S. V. REYNOLDS METALS COMPANY (COR-PORATE IMMUNITY FOR POLLUTION UNDER RIVERS AND HARBORS ACT OF 1899), 359 F. Supp. 338-339 (S.D. Texas 1973). 2 p.

Descriptors: \*Judicial decisions, \*Rivers and Harbors Act, \*Discharge, \*Pollution abatement, \*Oil pollution, Law enforcement, \*Texas, Legislation, Navigation, Water Quality Act, Federal Water Pollution Control Act, Water law, Oil wastes, Water pollution, Channels, Penalties.

The defendant, Reynolds Metals Company, was found guilty of violating the Rivers and Harbors Act of 1899 by discharging into a navigable waterway, the La Quinta Ship Channel, a quantity of oil from a shore facility. The court overruled the defendant's motion to suppress all evidence which stemmed from notification of the oil spill given by an employee of the defendant. The motion was predicated on the provisions of the Federal Water Pollution Control Act which require persons in charge of an on-shore facility to immediately report discharges of oil into the surrounding water to the appropriate federal agency. The provisions protect any such person from the use of such notification or information obtained by exploration thereof in any criminal matter. Based upon a later case at a higher level which held that a corporate owner operator was within the immunity granted by the Water Pollution Control Act the defendant was granted a new trial although the district court was reluctant in that if immunity lies, the Rivers and Harbors Act will be emasculated. (Gragg-Florida) W74-03426

U.S. V. STOECO HOMES, INC. (PERMANENT RESTRAINING ORDER ENJOINING DEVELOPER FROM CONDUCTING DREDGE, FILL AND CONSTRUCTION OPERATIONS). 359 F. Supp. 672-680 (D. N.J. 1973). 9 p.

Descriptors: \*Dredging, \*Navigable waters, \*Judicial decisions, \*Permits, \*Harbors, Environmental effects, Lagoons, Bays, Excavation, Landfill, \*New Jersey, Construction, Inland waterways, Constitutional law, Legal aspects. Identifiers: Injunctive relief, Fill permits.

The United States brought an environmental protection action for a permanent restraining order enjoining a New Jersey developer from conducting dredge, fill and construction operations. The government contended that the area of development is part of the navigable waters of the United States and that the defendant had conducted its operations without the prior approval of the Army Corps of Engineers. The defendant responded that its activities were not within navigable waters. Alternatively it contended that even if the waters are navigable, it did not violate federal law because its operations were conducted in an area shoreward of federally established or approved New Jersey State harbor lines, where, it further alleged, a permit is not required. The defenses of estoppel and laches as well as an unconstitutional violation of equal protection in the inconsistent enforcement statutes were also asserted. The United States District Court found the area in question to be within navigable waters and after considering each defense found them to be without merit. It entered an order permanently enjoining any further activity on the part of the developer. (Graggs-Florida) W74-03427

OPAL LAKE ASSOCIATION V.
MICHAYWE'LIMITED PARTNERSHIP (ACTION BY ASSOCIATION COMPOSED OF
RIPARIAN OWNERS AGAINST LAND
DEVELOPMENT COMPANY FOR INJUNCTION TO HALT DEVELOPMENT OF CLUB ON

# Group 6E-Water Law and Institutions

# COMPANY-OWNED SHORELINE).

209 N.W.2d 478-486 (Michigan 1973). 9 p.

Descriptors: \*Judicial decisions, \*Riparian rights, Pescriptors: "Juncial decisions, "Riparian rights, 
\*Reasonable use, \*Remedies, \*Lakes, Recreation, 
Lake shores, Construction, Water law, Riparian 
land, Equity, \*Michigan, Building, Legal aspects, 
Riparian waters. Identifiers: Injunctive relief.

This action, by an association composed of riparian owners, sought an injunction to stop a land development company from constructing a club on shoreline owned by the developer. Both the defendant and all but two of the plaintiff association's members own riparian land on a small lake. The development plans include residential lots, condominium units and mobile home sites as well as a recreation club on the lake to which all parties purchasing property in the development will be given membership. Based on the rule that on an inland lake where there are several riparian owners, such proprietors and their lesses and licensees may use the surface of the lake so long as they do not interfere with the reasonable use of the waters by other riparian owners, the lower court fashioned a tailored injunction. It restricted the number of people and boats that the club could allow on the lake. The Court of Appeals of Michigan, although agreeing the court could grant the injunction, reversed and remanded for further consideration due to the difficulty of enforcing the present injunction. (Gragg-Florida) W74-03428

JEFFERSON NATIONAL BANK AT SUNNY ISLES V. METROPOLITAN DADE COUNTY (SUIT SEEKING DECLARATORY JUDGMENT WITH RESPECT TO FILL PLACED IN BAY BY PLAINTIFFS).

271 So. 2d 207-214 (D.C.A. Fla. 1972).

Descriptors: \*Florida, \*Landfills, \*Riparian rights, \*Navigable waters, \*Bulkheads, Retaining walls, Coastal structures, Legislation, Legal aspects, Judicial decisions.

Identifiers: \*Coastal waters, \*Injunctive relief.

Plaintiff owned subdivision lots which fronted on Bella Vista Bay, a navigable body of water which connects with the Intracoastal Waterway in Dade County. Plaintiff extended its property into the Bay by the use of fill. When Metropolitan Dade County (County) learned of the fill, the County informed the plaintiff that the filling had been done without the requisite permit and that construction outside the official bulkhead line was impermissible. The plaintiff then brought action against the county asking the court to declare it the rightful owner of the filled land and praying for a mandatory injunction to require the defendant county to issue a permit for the construction of a retaining wall for said filled in land. The court found that ab sent a permit, the plaintiff was absolutely precluded from extending its property beyond that point, stating that the riparian right of the plaintiff did not confer upon it any ownership interest in the waters of the Bay. Thus the relief sought was denied and the fill was subject to removal. (McKnight-Florida)

#### HARBORS AND WATER-COURSES.

Ind. Ann. Stat. secs 48-5208 thru 48-5219 (Supp. 1972).

Descriptors: \*Indiana, \*Legislation, \*Harbors, \*Condemnation, \*Right-of-way, Water conveyances, Supply, Transfer, Water distribution, Water supply, Legal aspects, Water utilization, Eminent domain.

These are the Indiana Annotated Statutes dealing with condemnation proceedings for harbors and water-courses. The statutes provide that whenever the board of public works or public trustees of any town situated upon or adjoining any harbor con-nected with a navigable stream or lake, or upon any navigable channel, slip, waterway or water-course, shall desire to appropriate or condemn for the use of such city or town any property, real or personal, for a right-of-way for any sea walls or docks or other improvements of such harbor, it shall adopt a resolution to that effect, describing the property which may be injuriously or benefi-cially affected. Thereafter, all proceedings necessary in order to effect the completion of and payment for any such undertaking, including notice, appeal, letting of and performance of contracts, assessment and collection of payment for benefits as well as the determination and payment of damages to property, shall be the same to the ex-tent applicable as that for proceedings for street improvements of any such city or town by its board of public works or town trustees, as the case may be. (Mockler-Florida) W74-03430

# WATER LAW OF SOUTHEASTERN ESTUA-

Completion Report, June 21, 1972, 4 p. OWRR B-030-GA (2) 14-31-0001-1890.

Descriptors: \*Legal aspects, \*Estuaries, \*Water law, Boundaries, Public rights, Riparian rights, Prescriptive rights, Submerged lands act, Legislation, Tidal waters, Southeast U.S., Georgia, South

The most significant findings of the research concerning Georgia and South Carolina are the result of bringing together the various legal doctrines which control ownership and rights in estuarine areas. Summaries of these findings of existing law, which it is felt can be best understood if read with the background material explaining their develop-ment, are included in the body of the study (See W72-04348). Conclusions reached from the survey of statutory controls in both states indicate that neither state has multi-purpose estuarine area legislation. In Georgia regulatory control of the estuarine areas consists primarily of permit regulation of coastal marshlands. And in South Carolina statutory authority in the area is scattered among a number of agencies with differing and often conflicting powers and goals. W74-03463

A PLANNING MODEL FOR A WATER QUALI-TY MANAGEMENT AGENCY, SDL Inst., Toronto (Ontario).

For primary bibliographic entry see Field 05G. W74-03469

RESOURCE ALLOCATION, INFORMATION COST AND THE FORM OF GOVERNMENT IN-

TERVENTION, California Inst. of Tech., Pasadena. Environmental Quality Lab For primary bibliographic entry see Field 05G.

USEFUL WATERS FOR CALIFORNIA. California State Water Resources Control Board, Sacramento. For primary bibliographic entry see Field 05G.

MERCURY POLLUTION AND ENFORCEMENT

W74-03504

OF THE REFUSE ACT OF 1899 (PART 2). primary bibliographic entry see Field 05G. SELECTED LEGAL AND INSTITUTIONAL ASPECTS OF THE TEXAS COASTAL ZONE.
Texas Law Inst. of Coastal AND Marine Resources, Houston.

Summary report prepared for Texas Interagency Council on Natural Resources and the Environ-ment. March, 1973. 8 p.

Descriptors: \*Legal review, \*Water law, Repulsion (Legal aspects), Right-of-way, Water riparian rights, Water rights, Coasts, Navigation, \*Texas, Gulf of Mexico. Identifiers: \*Coastal-related legal matters, Texas

coastal law.

Five studies on coastal-related legal matters are summarized. The proceedings of the conference 'The Beaches: Public Rights and Private Use,' include discussions on the Texas Open Beach Act, one of the nation's earliest and most precise statutory definitions of public beaches which was the model for the National Open Beaches Bill. Inherent disadvantages of the bill are listed. Legal Assurance of Adequate Flows of Fresh Water into Texas Bays and Estuaries' first analyzes four segments of law to determine their capacity to provide estuarine protection and then specifies dif-ferent methods of implementation. Texas Seashore Boundary Law: The Effect of Natural and Artificial Modifications' examines the need for a greater clarification of the delineation of prolines due to the shiftings of the seashore boundary. Recommendations for legislative action are made. In exploring two major policy questions concerning Texas navigation districts, the study 'Texas Navigation Districts and Regional Planning in the Texas Gulf Coast Area,' concludes that (1) navigation districts should not be given primary responsibility for regional planning in the Texas Gulf Coast Area and (2) navigation districts should be subject to the same land use and environmental controls as other public and private entities. In Summary of Principal Regulations of Activities Affecting Texas Bays and Estuaries--a Preliminary Assessment,' a chart is described which identifies activities which are apt to result from development in various coastal economic sectors and the ment in various coastan economic security corollary governmental agencies having the power corollary governmental agencies have a corollary governmental agencies to regulate these activities. (Hoffman -Carolina) W74-03630

METROPOLITAN DEVELOPMENT GUIDE: PROTECTION OPEN SPACE--POLICY PLAN, Metropolitan Council of the Twin Cities Area,

Minn. For primary bibliographic entry see Field 06G. W74-03635

RESPONSIBILITIES OF LOCAL AUTHORITIES FOR WATER POLLUTION CONTROL For primary bibliographic entry see Field 05G. W74-03639

WATER AND SEWER STUDY: PART 2 PLANS AND PROGRAMS, SUMMARY REPORT BUN-COMBE COUNTY, NORTH CAROLINA. Register and Cummings, Asheville, N.C. For primary bibliographic entry see Field 05G. W74-03645

PUBLIC WORKS FOR WATER AND POWER DEVELOPMENT AND ATOMIC ENERGY COMMISSION APPROPRIATION BILL, 1974, PARTS 1 AND 2.

Hearings--Subcomm of the Committee On Appropriations--United States House of Representa-tives, 93d Cong., 1st sess., February 26, 1973. 2457

## Water Law and Institutions—Group 6E

Descriptors: \*Federal government, \*Administra-Descriptors: \*Federal government, \*Administra-tive agencies, \*Water resources development, \*Legislation, \*Navigation, Channel improvement, Dredging, Excavation, Wastewater (Pollution), Wastewater disposal, Wastewater treatment, Environmental engineering, Navigable waters, Water pollution, Water pollution control, Permits, Wastes.

Identifiers: Congressional hearings.

These hearings were concerned with the civil works appropriation request of the Corps of Engineers for fiscal year 1974. Extensive testimony was presented by representatives of the Corps of Engineers in support of their request, outlining the ongoing projects in need of continued funding and new projects for which funding was requested. Among the projects about which testimony was given were: research into the problem of wastewater management for urban areas; investigation of deepwater ports adaptable to supersized ves-sels; and the responsibilities of the Corps under the Federal Water Pollution Control Act of 1972. There was also testimony about the Corps of Engineers' dredging activities as well as their regula-tion of dumping into navigable waters. Maps and charts were included to illustrate the activities of the Corps in each of its divisions throughout the country and the costs of the various projects being conducted. The figures and the testimony were in support of the amount requested. (Flowers-W74-03710

#### EPA POLLUTION REGULATIONS AND FUEL THE IMPACT ON SHORTAGE: MASS

For primary bibliographic entry see Field 05G.

#### CRIMINAL OFFENSES--POLLUTION).

Tenn. Code Ann., sec. 39-2204 through 39-2206 (1932).

Descriptors: \*Tennessee, \*Penalties (Legal), "Water pollution abatement, "Administration,
"Legislation, Pollutant identification, Water
supply, Structures, Water pollution, Public health,
Law enforcement, Water pollution control, Municipal water, Water quality control, Water quality act, Water works.

Criminal penalties are provided for violation of pollution laws and, more specifically, pollution of water in various ways. Throwing dead animals into any spring, well, cistern, or running stream of water, or willfully injuring pumps, reservoirs, tanks, etc. which supply water for domestic or manufacturing are declared to be misdemeanors. This statute applies to government structures as well as private or commercial waterworks and provides for the allocation of any fines collected. (Sutton-Florida) W74-03722

#### ZONING--SUBDIVISION OF LAND. Conn. Gen. Stat. Ann., sec. 8-25 (Supp. 1972).

Descriptors: \*Connecticut, \*Sewage, \*Sewage disposal, \*Flood control, \*Drainage, Water, Water pollution, Drainage Systems, Water pollution treatment, Legislation, Zoning, Land use, Project planning.

Land subdivision must be approved by the commission prior to subdivision of land and all plans filed with the town and/or district clerk's office. The commission is required to adopt regulations pursuant to this section prior to exercising the powers granted. The regulations must provide that the land be of a character that will not endanger health or public safety, and proper provision must be made for water, drainage and sewerage. They must also provide for controls of water subject to flooding, and streets and throughfares must form an adequate and convenient system for present and prospective traffic needs. There must be provisions for open spaces and parks, and the commission may accept bonds in amounts sufficient to secure the actual construction and installation of any of the above required improvements, or provide for an assessment to secure such installations. (Ritchie-Florida) W74-03723

#### CONSTRUCTION AND MAIN-OVER OR ADJACENT TO RRIDGE TENANCE STREAMS.

Conn. Gen. Stat. Ann., sec 13a-94 (Supp. 1972).

Descriptors: \*Connecticut, \*Bridge construction, Descriptors: "Connecticut, "Bridge construction, "Flood control, "Environmental protection, Civil engineering, Flood damage, Flood protection, Engineering structures, Bridge design, Public rights, Public health, Public safety, Water law, Legislation, Public benefits.

These provisions express the necessity for protection of streams from problems which may be caused by adjacent highway projects. The requirements for the highway projects are set by the commissioner of environmental protection. Specifi-cally, requirements are established for future highways adjacent to any stream subject to flood control measures. Any bridge in existence on a specified date must be rebuilt or modified in order to meet the requirements of the flood control plan. Provision is made for funds from which the costs of modifying structures may be paid. (Proctor-W74-03724

# WASTEWATER LAND TREATMENT SITE

REGULATION ACT.
Ill. Pub. Acts (1973), ch. 78-350, sec. 1 through 10, to be codified as, Ill. Stat., ch. 111 1/2, sec. 581 to

Descriptors: \*Illinois, \*Waste water disposal, Waste water treatment, \*Treatment facilities, waste water treatment, "freatment facilities, 'Sludge treatment, Sewage lagoon, Aerobic treat-ment, Wastewater, Permits, Environmental con-trol, Legislation, Regulation, Administration, Sewage treatment, Administrative agencies.

The act authorizes the establishment and operation of wastewater land treatment sites or digested sludge utilization sites. No person can establish, operate, manage or maintain any wastewater land treatment site or any digested sludge utilization site without first obtaining a permit from the Illinois Environmental Protection Agency. Before a permit is issued a steering committee is to be formed to advise, recommend and issue a report relative to the site. Any person violating this act is subject to a \$10,000 maximum fine for each offense. Provisions are established for proper hearings as well as for judicial review of all deci-sions. (Daniels-Florida) W74-03725

#### RECREATIONAL USE OF LAND AND WATER AREAS--LIABILITY OF OWNERS.

Ill. Pub. Acts (1973), ch. 78-489, sec. 1, to be codified as, Ill. Stat., ch. 70, sec. 32.

Descriptors: \*Illinois, \*Legislation, \*Statute, \*Recreation, \*Public access, \*Water utilization, Legal aspects, Human Population, Adjacent landowners, Administration, Lakes, Competing uses. Identifiers: \*Liability.

The Act limits the liability of landowners who make their land and water areas available to the public for recreational purposes. The amended section 2 more definitely defines terms used in the Act including land, owner, recreational purpose,

charge, and person, and it became effective October 1, 1973. (Sutton-Florida) W74-03726

#### INTERTIDAL SALT MARSHES. PENALTY.

R. I. Gen. Laws Ann., sec. 11-46.1-1 (Supp. 1972).

Descriptors: \*Salt marshes, \*Fish management, \*Environmental effects, \*Legislation, Rhode \*Environmental effects, \*Legislation, Rhode Island, State jurisdiction, Water law, Fish populations, Penalties, Law enforcement, Regulation, Water resources development, Administrative agencies, Tidal marshes.

A permit program is set up to be administered by the Rhode Island department of natural resources for activity on intertidal salt marshes. Penalties are established for persons who deposit mud, dirt, or rubbish upon, or who excavate and disturb the ecology of intertidal salt marshes without first obtaining a permit. The statute further provides that any offenders may be ordered to restore such salt sh to the extent practical. The director of natural resources shall refuse to issue a permit if in his judgment the ecology of the salt marshes will be disturbed by any activities delineated above. (Proctor-Florida) W74-03727

# DEPARTMENT OF NATURAL RESOURCES-

R. I. Gen. Laws Ann., sec. 42-17, 1-4 (Supp. 1972).

Descriptors: \*Rhode Island, \*Water resources, \*Wetlands, \*Marshes, \*Coastal engineering, Aquatic habitats, Administration, Fisheries, Education (Social aspects), Environmental control. Fish management, Flood control, Dams (Engineering structures), Reservoirs, Project planning, Legislation, Administrative agencies, Natural resources.

Identifiers: Public education (Information dissemination).

Provisions establishing divisions within the Rhode Island department of natural resources are set forth. The division of fish and wildlife will function to protect fishing, wetlands and marsh areas. The division of coastal resources shall regulate flood control, harbor and shorelines, and shore development. The division of planning and development is established to disseminate information relating to natural resources and to inspect dams and reservoirs. The section also provides for an enforcement division. (Proctor-Florida) W74-03728

#### ELIMINATION OF MOSQUITO-BREEDING PLACES.

Conn. Gen. Stat. Ann., sec. 19-50 (Supp. 1972).

Descriptors: \*Connecticut, \*Mosquitoes, \*Public health, \*Insect control, \*Breeding, Legislation, Excavation, Construction, Physical control.

The Connecticut commissioner of health is charged with the dity of issuing regulations con-cerning the elimination of mosquitoes and mosquito-breeding places, and his agents have authority to enter upon land to make any excavations or structures necessary to effect such elimination. The commissioner shall assess the damage to each particular piece of land caused by elimination of breeding areas and notify, by publication and directly, the record land owners of the proposed work and his assessment of the damage e caused. The land owner may then appeal the order and assessment to the court of common pleas. (Ritchie-Florida) W74-03730

# Group 6E—Water Law and Institutions

ESTABLISHMENT OF AIRPORTS ON PUBLIC WATERS AND RECLAIMED LANDS. Tenn. Code Ann., sec. 42-305 (1957).

Descriptors: \*Tennessee, \*Legislation, \*Airports. Water law, \*Land reclamation, Land use, Structures, Landfülls, Land development, Surface drainage, Cities, Public lands, Water policy, Water utilization, Water structure.

Municipalities are authorized to acquire, establish and maintain, within the municipality's boundaries, airports in, over and upon any public waters, or any submerged lands under public waters. This includes artificial or reclaimed lands which before the artificial making or reclamation constituted a portion of the submerged lands under such public waters. The municipality may construct and maintain buildings, causeways, roadways and bridges connecting with any such airport, and landing floats and breakwaters for the protection thereof. (Silber-Florida) W74-03731

#### STATE SHELL-FISHERIES.

Conn. Gen. Stat. Ann., sec. 26-195 (Supp. 1972).

Descriptors: \*Connecticut, \*Shellfish, \*Aquatic life, \*Aquiculture, \*Boundary disputes, Legislation, Fisheries, Legal aspects, Water law.

The Connecticut commissioner of agriculture, on the petition of any interested person, is emered to resolve all questions and disputes regarding the ownership, title, extent or location of any shell-fish grounds. The commissioner shall summon all parties in interest, who shall file sworn statements and counterstatements, upon which the commissioner shall make his determination. The commissioner's decision will be binding on all parties summoned to the hearing unless appealed to the court of common pleas within ten days. No appeal will be allowed until the party appealing has become bound to the adverse party, with sufficient surety, conditioned to prosecute such appeal to effect. (Ritchie-Florida) W74-03732

#### WATER POLLUTION CONTROL.

Conn. Gen. Stat. Ann., sec. 25-54b to 25-54d, 25-54g to 25-541, 25-540 to 25-54s, 25-54hh, 25-54mm, 34g to 25-341, 25-340 to 25-345, 25-3411, 25-34111, 25-34011, 25-3401, 25-3

Descriptors: \*Connecticut, \*Water pollution, \*Sewage, \*Sewage disposal, \*Water pollution control, Legislation, Discharge (Water), Permits, Pol-lution abatement, Public health, Phosphorus, De-tergents, Municipal wastes, Treatment facilities.

Section 25 of the Connecticut statutes reassigns water pollution control from the water pollution control administration to the state's environmental protection agency. The powers and duties of the commissioner of the environmental protection agency include general administration of the water pollution laws, development of plans for prevention and abatement of pollution, consultation with other agencies, and submission of plans, reports and accounts to federal agencies. He may provide grants to municipalities to finance facilities essential for the separation of storm and sanitary sewage, as well as establish categories of arges for which he, or someone to whom authority is delegated, may issue permits. Following enactment, no person or municipality may initiate any new discharges into the waters without a permit from the commissioner. If the permit is de-nied, the commissioner shall require the applicant to submit plans for a pollution control system which is adequate to protect the waters. The statute also requires labeling of phosphorus content on detergents, and firms offering detergents for sale must file a statement with the commissioner listing the active ingredients. Provisions are included for appealing the commissioner's rulings as well as penalties, including injunctive relief for violating the act. (Ritchie-Florida) W74-03733

#### MUNICIPALITIES--LAKE AUTHORITIES.

Conn. Gen. Stat. Ann., sec. 7-151a (Supp. 1972), as amended, act 73-241, sec. 1,2 (1973), Pub. Acts of

\*Connecticut. \*Administration. Descriptors: Descriptors: "Connecticut, "Administration, "Legislation, "Law enforcement, "Cities, Pollution abatement, Cost allocation, Water quality control, Project planning, Permits, Water management (Applied), Legal aspects, Water quality standards, Water pollution control, Lakes.

The Act concerns the powers of lake authorities, granted by township legislative bodies, and the acceptance of gifts by such authorities. The lake authority will be composed of three delegates from each member town and each member town shall pay to the authority its respective share of the ex-penses, prorated on the basis of its linear footage of shore line. The Act then provides for withdrawal procedure by member towns from the commission. Subsection two grants additional powers to the authority, including control and abatement of algae and aquatic weeds, to act as agents for member towns with respect to filing applications for grants and reimbursements and receiving gifts and also the power to carry out water management studies. (Sutton-Florida) W74-03734

### DAM CONTROL ACT.

W. Va. Code Ann., sec. 20-5D-1 through 20-5D-14

Descriptors: \*West Virginia, \*Dam design, \*Dam construction, \*Dam failure, \*Engineering structures, Impoundments, Flow control, Water contures, impoundments, Flow control, water con-trol, Penalties (Legal), Legal aspects, Law en-forcement, Regulation, Public helath, Public safety, Water law, Public rights, Public benefits, Administrative agencies, Legislation.

In establishing controls for the construction, operation, and maintenance of dams in the state, the legislature recognizes the necessity for regulation and supervision to protect the health, safety, and welfare of persons and of property. Provisions establish the duties and powers of the director of natural resources with respect to dam control. His authority extends to the issuance of certificates of approval prior to any construction, alteration, or repair of a dam. Approval or disapproval of an application for the issuance of a permit is based on the sufficiency of such application. Certificates already issued may be revoked or suspended. A provision delineates the necessity of inspections during the construction or repair of dams to insure compliance with approved plans and specifications. Remedial actions on the part of the director to alleviate possible emergencies, and procedures for handling actual emergencies are established. Certificates of approval must be obtained both for dams already constructed as well as dams under construction prior to the effective date of the article. Penalties are imposed for violations of the provisions of the article. (Proctor-Florida) W74-03735

#### OHIO RIVER VALLEY WATER SANITATION COMMISSION.

W. Va. Code Ann., sec. 29-1D-1 thru 29-1D-6 (1972).

Descriptors: \*River basin commissions, \*Interstate compacts, \*Interstate commissions, terstate compacts,

\*Water pollution control, \*West Virginia, Abatement, Water pollution treatment, Water quality control, Contamination (Water), Pollution (Water), Industrial wastes, Municipal wastes, Recreation, Legislation.

This West Virginia statute enacts into law an interstate sanitation compact between the states of Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Tennessee and West Virginia. The purpose of the compact is to control future pollution and abate existing pollution in the Ohio River Valley drainage basin. The compact provides for treatment of sewage and industrial wastes with the primary goals to protect public health as well as preserve the waters for other legitimate purposes such as municipal and industrial water supplies and recreation. A commission shall conduct a survey of the territory included, study the pollution problems of the district, and make a comprehensive report using advice from national or regional planning bodies or consultants. The commission may order municipalities, corporations, persons, or other entities to abate or modify discharges. The commission or, at its request, the attorney general or other law-enforcing official, shall have power to bring suit to enforce such order. The statute also set out the methods of appointment, powers and duties of the commission for the state of West Virginia. (Worsham-Florida) W74-03736

#### TUNING DOWN THE GNP. Reilly, Like and Schneider, Babylon, N.Y. For primary bibliographic entry see Field 06G. W74-03744

ATTITUDES CHANGING IN WATER RESOURCES DEVELOPMENT IN PROVINCE OF MANITOBA,
Department of Mines and Natural Resources, Winnipeg (Manitoba). For primary bibliographic entry see Field 06B. W74-03747

#### 6F. Nonstructural Alternatives

LEGAL FACTORS IN ECONOMETRIC MODELING OF LOCAL FLOODPLAIN MANAGEMENT DEVICES IN THE CONNEC-TICUT RIVER BASIN,

Massachusetts Univ., Amherst. Water Resources Research Center.

Available from National Technical Information Service as PB-226 765; \$4.75 in paper copy, \$1.45 in microfiche. Completion Report, Publication No 34, September 1973. 48 p, 1 fig, 2 tab.

Descriptors: \*Cost-Benefit analysis, \*Econometrics, Flood plains, \*Legal aspects, Model studies, Data collections, \*Building codes, \*Flood plain zoning, Computers, Water policy, \*Connecticut

Content covers: administrative and legal contexts for use of econometric models in floodplain management strategies and problems of reducing vulnerability of models by measures to show accuracy of the process used to arrive at data inputs, persuasiveness of sources, and quality controls for calculator and computer runs. W74-03207

CALIFORNIA COASTAL ZONE CONSERVA-TION ACT, INTERIM PERMIT CONTROL, GENERAL,

University of Southern California, Los Angeles. I. Perry.

U.S.C. Sea Grant Program, School of Public Administration, USC-SG-ASI-73. 1 p, 1 chart.

Descriptors: \*California, \*Permits, \*Legal aspects, \*State governments, \*Coastal plains, Legislation, Planning, Standards, State jurisdic-Identifiers: California Coastal Zone Conservation

Act of 1972. Coastal waters.

Depicted is a chart showing the Interim Permit Control review process of the California Coastal Zone Conservation Act of 1972 (ACT) in a simplified form. It is intended for managers, labor unions, lenders, environmentalists, and other interested parties and to illustrate the main features of the permit process. Certain contingencies are beyond the scope of the work. Accompanying text material is intended to explain the chart and the appropriate regulations in an understandable form but not to explain involved details of the Act and regulations. This work is a simplified interpretation at a particular point in time, and is to be used only as an aid or guide for understanding the general permit process, and should not be construed as advice on the actual law. Included are legal and procedural time factors, and information on the public hearing phase, application decision phase, appeal phase, permit approval phase, emer-gency permits and future changes. Any development taking place within the coastal zone permit area between November 1972 and February 1977 must be approved by a permit granted by one of six regional coastal zone commissions. (Sears-Florida) W74-03379

A BILL TO ESTABLISH A NATIONAL FLOOD PLAIN POLICY.

For primary bibliographic entry see Field 06E.

FLOOD PLAIN STUDY AND MODEL FLOOD PLAIN ORDINANCE (FINAL ENVIRONMEN-TAL IMPACT STATEMENT).

Available from NTIS, U.S. Dep't of Commerce a PB-213-521, for \$5.00 paper copy. March 1972. 45 p, 3 fig, 3 map, 3 tab, 9 ref.

Descriptors: \*Florida, \*Coasts, \*Coastal plains, \*Flooding, \*Flood control, Flood proofing, Flood forecasting, Flood data, Crest-stage gages, Flood frequency, Flood protection, Flood recurrence in-terval, Insurance, Building codes. Identifiers: \*Environmental impact statements.

This report deals with the flooding problems of the Eastern Coastal Areas of Palm Beach County, Florida, and offers methods by which the more serious effects of heavy flooding could be minimized or avoided. Sections of the report are concerned with the patterns of development in Palm Beach County, a review of past flooding situations in the eastern areas and the determining of flood criteria as established by the Corps of Engineers. Also included are proposed flood hazard ordinance criteria, a model flood hazard district, flood proofing criteria, subdivision criteria and methods of controlling coastal flooding. It is intended that the information presented in this report will provide guidelines for local governing bodies in their adoption of flood control measures. Furthermore, this report hopes to assist local governments in adopting required legislation re-garding flood prevention by presenting the following data: background information regarding past flooding conditions countywide; base map show-ing the limits of the 100 year floodcrest; sum-marization of federal criteria for regulatory controls to be adopted for prevention of flood damage; and a model ordinance for the establishment of a flood hazard zone district that meets general federal criteria and is adaptable to existing zoning codes. W74-03397

THE GREAT MIAMI RIVER CORRIDOR STU-DY: A CONCEPT PLAN.

Kiley (Dan) and Partners, Charlotte, Vt.

May, 1972. 41 p, 13 fig, 67 ref.

Descriptors: Rivers, \*Recreation, \*Parks, \*Planning, Water sports, Flood plains, Aesthetics, Landscaping, \*Land use, Access routes, \*Ohio. Identifiers: Open space, \*Great Miami River (Ohio), Dayton, Ohio, Mad River (Ohio), Flood plain management, River Corridor, Stillwater River (Ohio)

The Great Miami River has been very important in the location and economic growth of the Dayton metropolitan area. The River is now seen as a key element in developing the recreational and ameni-ty aspects of the area. There is great potential for using the continuity of the River Corridor as a unified system of parks, open areas, and scenic transportation routes. The 60 miles of levees and walls along the River, the numerous dams and reservoirs, and the floodplains which have been restricted from urban development can all be used for recreational, environmental, and amenity pur-poses in addition to their primary purpose of flood control. The River Corridor's development plan is based on several planning principles and concepts including the use of land use planning and zoning, including the use of land use planning and zoning, the maintenance of continuity, emphasis on the visual impact of the River, public access systems and various paths and trails within the Corridor, planned unit residential development, and in planned unit residential development, and im-proved water-based recreation. The plan includes 92 specific projects or opportunities within the Corridor and gives special emphasis to paths and trails, water sports, landscaping, slope protection, and the use of old gravel pits for lagoons and hills. (Elfers - North Carolina) W74-03631

METROPOLITAN DEVELOPMENT GUIDE: PROTECTION OPEN SPACE--POLICY PLAN,

Metropolitan Council of the Twin Cities Area. For primary bibliographic entry see Field 06G. W74-03635

WATER SUPPLY AND DISTRIBUTION. Somerset County Planning Board, Somerville, For primary bibliographic entry see Field 06D. W74-03647

# 6G. Ecologic Impact of Water Development

**ASPECTS ENVIRONMENTAL** OF WATERSHED PLANNING, Soil Conservation Service, Jackson, Miss.

E. G. Sullivan. In: Proceedings of 8th Mississippi Water Resources Conference, April 10-11, 1973, p 31-37,

Descriptors: \*Environmental control, \*Federal project policy, \*Mississippi, \*Projects, Watershed management, Planning, Third party effects, Reviews, Ecology, Ecosystems, Water quality control, Water pollution control, Evaluation.

A review of the impact of the National Environ-A review of the impact of the National Environmental Policy Act of 1969 on watershed projects in Mississippi is presented. Mississippi had 45 watersheds which came under the policy for restudy. These were both Public Law-366 and flood prevention projects. Criteria for this study were (a) effect of project on the environment, (b) conformance to enumerated guidelines, and (c) economic justification. A team of biologists from the U.S. Fish and Wildlife Service, Mississippi Game and Fish Commission, and Soil Conservation Service (SCS) met and worked out systems for the environmental studies and agreed on methods. Most of the field work was done by SCS biologists in consultation with the other agency personnel. Each project was placed in one of three groups under the above criteria. If a project was placed in group one under all three criteria, there were no significant problems. Few projects fell in this category. Group two projects were flagged for restudy on certain environmental problems which were evident. Group three projects required a total restudy and reevaluation from all aspects. At the time of completion of this study there were 45 protime of completion of this study there were 45 projects in Mississippi which were evaluated under these criteria. Of these, 15 were in group one, 19 were in group two, and 12 were in group three. This study was completed in June of 1971. (See also W74-03212) (Woodard-USGS) W74-03215

WATER LAW AND ITS RELATIONSHIP TO ENVIRONMENTAL QUALITY: A BIBLIOG-RAPHY OF SOURCE MATERIAL, Colorado State Univ., Ft. Collins. Dept. of For primary bibliographic entry see Field 05G. W74-03322

ENVIRONMENTAL LAW - WATER POLLU-TION REMEDIES - USE OF PUBLIC NUISANCE THEORY IN SUIT BY FEDERAL GOVERN-MENT - UNITED STATES V. IRA S. BUSHEY AND SONS, INC.,
For primary bibliographic entry see Field 05G. W74-03381

THE SUBSTANTIVE RIGHT TO ENVIRON-MENTAL QUALITY UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT, For primary bibliographic entry see Field 06E. W74-03384

FLOOD PLAIN STUDY AND MODEL FLOOD PLAIN ORDINANCE (FINAL ENVIRONMENTAL IMPACT STATEMENT). For primary bibliographic entry see Field 06F. W74-03397

BANKLICK CREEK WATERSHED (FINAL EN-VIRONMENTAL IMPACT STATEMENT). Soil Conservation Service, Washington, D.C. For primary bibliographic entry see Field 04D. W74-03398

FINISH ALLATOONA'S INTERSTATE RIGHT. INC. V. VOLPE (SUIT TO ENJOIN CONSTRUC-TION OF LAST SEGMENT OF HIGHWAY 1-75 ACROSS PORTION OF PUBLICLY OWNED

For primary bibliographic entry see Field 06E. W74-03405

PEOPLE OF SAIPAN V. UNITED STATES DEPT. OF INTERIOR (ACTION TO ENJOIN CONSTRUCTION OF HOTEL ON PUBLIC LAND UNTIL ENVIRONMENTAL IMPACT OF HOTEL HAS BEEN EVALUATED), For primary bibliographic entry see Field 06E. W74-03406

CENTRAL BUCKS JOINT SCHOOL BUILDING AUTHORITY V. RAWLS (ACTION BY LAN-DOWNER TO RECOVER COMPENSATION FOR ALLEGED DE FACTO TAKING OF PRO-

303 A 2d 863-867 (Pa Cmwlth 1973). 5 p.

# Group 6G-Ecologic Impact of Water Development

Descriptors: \*Pennsylvania, \*Sewage effluents, \*Sewage disposal, \*Waste water (Pollution), \*Property values, Real property, Legal aspects, Judicial decisions, Facilities, Eminent domain. Identifiers: Nuisance (Legal aspects).

The plaintiff was a landowner who brought suit against the school building authority to recover for de facto taking of property. Plaintiff alleged that the emptying of the outfall sewer line from a school near her property created the following conditions: a quanity of effluent greater than any surface water which might otherwise have flowed onto her land; unpleasant odors; erosion of the stream bank and bed; unsightly growth of weeds on the stream bank: a danger of raw sewage being discharged into the stream; and the existence of a conspicuous sewer pipe, the operation and presence of which depreciated the value of her property. The court stated that although the concept of a de facto taking was relatively new, it is now established that there may well be a compensable injury to the enjoyment of one's property although the power of eminent domain has not been formerly exercised against the property. Thus, the effects of the sewer pipe's installation had deprived the plaintiff of real and material rights in the enjoyment of the property and for this injury, compensation was proper. (McKnight-Florida) W74-03409

COMING TO TERMS WITH GROWTH AND THE ENVIRONMENT, Minnesota Univ., Minneapolis. Dept. of

Minnesota Univ., Minneapolis. Dept. Economics.
For primary bibliographic entry see Field 06B.
W74-03465

ANALYZING THE ENVIRONMENTAL IM-PACTS OF WATER PROJECTS. Stanford Univ., Calif. Dept. of Civil Engineering.

Available from the National Technical Information Service as AD-766 286 \$8.75 in paper copy, \$1.45 in microfiche. Army Engineer Institute for Water Resources, Alexandria, Virginia, IWR Report 73-3, March 1973. 432 p, 16 fig, 12 tab, 208 ref. DACW 31-71-C-0127.

Descriptors: "Analytical techniques, "Methodology, "Environmental effects, "Water resources development, Legal aspects, Flood control, Water quality, Physical properties, Reservoirs, Social values, Recreation, Dredging, Biological properties, Chemical properties, Waste disposal. Identifiers: "Environmental impact statements,

Identifiers: \*Environmental impact statements, Carmel River Basin (Calif.), Stream channelization.

A systematic methodology for the identification, description, measurement and display of the environmental impacts associated with water resources development activities was developed and tested by seminar students at Stanford University. A framework defining and relating the major factors and terms relevant to environmental impact assessment, together with a general analytical approach is suggested, and a number of state-of-the-art reviews on the significant physical, biological and chemical impacts of impoundments, stream channelization, and dredging and spoil disposal, and flood control and recreation are presented. Also covered are requirements, problems and issues relevant to the analysis of ecological, visual, cultural and induced impacts, as well as staffing needs and other considerations. A case study performed by workshop participants involving several alternative reservoir projects on the Caramel River Basin in California is included. (Slattery-Wisconsin) W74-03472

THE RESOLUTION OF UNCERTAINTY, George Washington Univ., Washington, D.C. National Law Center. For primary bibliographic entry see Field 05G. W74.0349

ECONOMIC GROWTH AND ENVIRONMENTAL DECAY: THE SOLUTION BECOMES THE PROBLEM, Washington State Univ., Pullman. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 06B. W74-03492

POLLUTION: ECONOMY AND ENVIRON-

MENT, Kent Univ., Canterbury (England). Dept. of Economics. For primary bibliographic entry see Field 06B.

CONSTRUCTING NONLINEAR DYNAMIC MODELS FOR SOCIO-ENVIRONMENTAL DECISIONMAKING: A METHODOLOGY, California Univ., Davis. Inst. of Governmental Affairs.

For primary bibliographic entry see Field 06A.

NATURAL FEATURES ELEMENT OF THE COMPREHENSIVE PLAN: A PLAN FOR ACTION.

DeKalb County Planning Dept., Decatur, Ga. For primary bibliographic entry see Field 04C. W74-03633

CONSERVATION-OPEN SPACE PLAN;
AMENDMENTS TO THE SPRINGFIELD COMPREHENSIVE PLAN.
Springfield Planning Dept., Mass.
For primary bibliographic entry see Field 03D.
W74-0363.

METROPOLITAN DEVELOPMENT GUIDE: PROTECTION OPEN SPACE-POLICY PLAN, PROGRAM. Metropolitan Council of the Twin Cities Area,

April, 1973. 21 p.

Descriptors: Natural resources, \*Conservation, \*Wetlands, \*Minnesota, \*Water courses, Planning, Urbanization, Recreation, Hydrologic aspects, Environmental effects, Floodplains, Soils, Coordination, \*Comprehensive planning, Identifiers: \*Open space, Land use controls, Twin Cities (Minn.), Minneapolis (Minn.), St. Paul (Minn.)

This comprehensive policy plan for protecting open space is one element of the Metropolitan Development Guide and focuses on 'protection of open space' as contrasted with recreation open ace. Natural resource categories to be protected include water bodies and water courses, wetlands. groundwater recharge areas, floodplains, erodible slopes, forests and woodlands, soils with severe limitations for development, production lands, and areas containing unique or endangered plants and animals. Policies relating to water resources clude: Proper management of water bodies through enforcement of Minnesota pollution control standards will provide a supply of clean water to domestic and industrial uses. Natural watercourses should be included in local comprehensive plans and should be preserved and managed to handle storm runoff. Wetlands should be protected against alterations which would disrupt the local hydrologic and ecological systems. Major groundwater recharge areas should be mapped and included and included in future comprehensive plans. Development within recharge areas must not have a detrimental effect on groundwater quality or quantity. Counties and municipalities should designate a 100-year floodplain for all watercourses based on anticipated development in their watershed. Implementation of these policies is discussed and includes the coordination of state, metropolitan, local, and private interests and agencies, and the use of land use controls and tax incentives. (Elfers - North Carolina) W74-03635

TROPICAL BAY IN DANGER, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla.

Sea Frontiers, Vol 18, No 2, p 66-74, March-April 1972, 1 map, 8 photo.

Descriptors: \*Florida, \*Mangrove swamps, \*Erosion, \*Spawning, \*Ecosystems, \*Inland waterways, Nutrients, Water quality, Food chains, Fish, Marine bacteria, Marine plants, Marine animals, Fisheries, Estuaries. Identifiers: \*Fill permits.

Much pressure is being applied by land developers for the removal of mangroves from southern Biscayne Bay and Card Sound in south Florida. However recent scientific studies have elucidated the role of mangrove ecosystems, and found them to be important for numerous purposes. In addition to their function as nurseries for young fishes, such areas are sites of abundant spawning. Mangroves also protect coastal areas from storms, per-mit land build-up of the areas, and tend to prevent erosion. They filter surface water runoff, thereby preventing large nutrient losses to the sea. They also cause a decrease in the velocity of inshore water which reduces suspended particulate matter water which reduces suspended particulate matter and promotes water quality. Perhaps their greatest contribution lies in the role which they play in the food chain of many south Florida fisheries. Man-grove leaves die and fall into the water, where they are decomposed by bacteria and fungi. Eventually, they become fine matter of high nutritive value called organic detritus. Detritus feeds microscopic marine organisms, which are in turn fed on by larger organisms such as pink shrimp, clams and numerous fishes. Despite the importance of man-groves, the ecological balance of the area is beginning to show signs of environmental stress. (Ritchie-Florida) W74-03716

THE RIVER OF GRASS IS DRYING UP,

G. Reiger. National Wildlife, Vol 12, p 54-62, December-January 1974. 1 map, 2 illus, 9 photo.

Descriptors: \*Florida, Land reclamation, \*Much soils, \*Irrigation canals, \*Wetlands, \*Land development, Marshes, Peat, Mangrove swamps, Lakes, Surface waters, Shallow water, Canals, Saline water intrusion, Surface drainage, Flooding, Standing waters, Grasses, Groundwater, Percolating water, Running waters, Water sources, Zone of saturation. Identifiers: \*Everglades.

Since 1880 the efforts of man to control the flow of water in southern Florida have reduced the Everglades to half of its original size. For thousands of years the vast interior muck lands functioned like a giant sponge, holding water during the wet seasons and gradually releasing it during dry times. In an attempt to make the wet region fit for human habitation and farming, sprawling networks of canals have been constructed. Through the years these canals have also precipitated a series of natural disasters ranging from persistent fires to sudden floods. Today they continue to upset the delicate balance of nature that prevails—momentarily at least—throughout the area. Slowly the

Everglades is drying up, and if it does, an enormous and intricate system of life will perish. As south Florida confronts continued growth and development, it also faces accelerated impoverishment of all of its natural resources. (Comfort-W74-03718

### THE IMPERILED EVERGLADES.

F. Ward. National Geographic, Vol 141, p 1-27, January 1972. 2 chart, 13 photo.

Descriptors: \*Florida, \*Flood control, \*Drainage systems, \*Surface drainage, \*Wildlife manage-ment, Flood routing, Dikes, Flow control, Aquifers, Aquifer management, Water sources, Saline water intrusion, Abatement, Watershed management, Burning. Identifiers: \*Everglades.

The series of rampaging fires which destroyed large parts of the Everglades in 1971 were the result of a larger crisis which threatens the Everglades and the entire population of South Florida. The crisis is water--how it is managed and for what purpose. The Everglades suffered through a severe drought in 1970 and 1971. The activities of man in draining and developing the area magnified the adverse effects of the drought. The entire Everglades area was once covered by water. The flow of water over the Everglades is essential to the prevention of salt water intrusion into the aquifer from which the Miami area draws its drinking water. However, water levels have been upset both above and below the surface. Development in the Big Cypress swamp from which the Ever-glades receives 56% of its surface waters is partially to blame. But the major problem stems from the drainage of all the land south and east of Lake Okeechobee except for the Everglades Park and certain water conservation areas, for the purpose of flood control. Proposed solutions are reflo the entire area as well as raising the level of Lake Okeechobee. (Flowers-Florida) W74-03720

#### DISPOSAL OF OLD VESSELS AND FLOATING STRUCTURES.

Conn. Gen. Stat. Ann., sec. 15-31 (Supp. 1972).

Descriptors: \*Harbors, \*Navigation, \*Rivers, \*Permit, \*Navigable rivers, \*Connecticut, Administrative agencies, Legislation, Flotsam, Penal-ties (Legal), Transportation. Identifiers: Navigation obstructions.

Anyone who allows his vessel, scow, lighter, or similar floating structure to be broken, run aground, or altered to such an extent that it will not float with ordinary care within the confines of any river or harbor shall be subject to a fine and/or imprisonment. However, such owner shall not be subject to such penalties if he first obtains a permit from the commission of transportation. (Comfort-Florida) W74-03729

TUNING DOWN THE GNP. Reilly, Like and Schneider, Babylon, N.Y. Environment, Vol 15, No 6, p 6-15, 1973. 52 ref.

Descriptors: \*Gross national product, \*Decision making, Federal government, \*Environmental effects, Political aspects, Cost-benefit analysis, \*Government finance.
Identifiers: \*Environmental impact statements,

Federal Reserve Board.

Under the National Environmental Policy Act, environmental impact statements are required of all federal agencies whose duties significantly affect the quality of the human environment. For the most part, the requirement has been applied only to agencies controlling or financing particular pro-jects. Federal fiscal and monetary policies, which often have a cause-effect relationship with these projects are not under the scrutiny of this Act. The Federal Reserve Board was chosen to illustrate the effects of alternative monetary policies on project benefits and environmental costs and to suggest how the NEPA might be applied to all federal agencies exercising economic power. The Board's policy to encourage growth is examined in the light of recent articles on pollution. The environmental effects of: (1) credit and monetary policy designed to stimulate a steady state or recycling economy;
(2) preferencial treatment to industries installing pollution abatement equipment; and (3) environ-mental protection standards governing all loans subject to the FRB regulatory power, are evaluated. (Schroeder-Wisconsin) W74-03744

### 07. RESOURCES DATA

### 7A. Network Design

DESIGN OF OPTIMAL PRECIPITATION NET-MORKS,
Massachusetts Inst. of Tech., Cambridge. Ralph
M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02B.
W74-03333

### 7B. Data Acquisition

ROLE OF BOREHOLE GEOPHYSICS IN UN-DERGROUND WASTE STORAGE AND ARTIFI-CIAL RECHARGE,

Geological Survey, Denver, Colo. For primary bibliographic entry see Field 05E. W74-03229

A CULTURE SYSTEM FOR ARTEMIA, DAPHNIA, AND OTHER INVERTEBRATES, WITH CONTINUOUS SEPARATION OF THE

Ghent Rijksuniversiteit (Belgium). For primary bibliographic entry see Field 05A. W74-03283

A NEW METHOD FOR THE ESTIMATION OF ABSOLUTE MICROFOSSIL NUMBERS, WITH REFERENCE ESPECIALLY TO DIATOMS,

Uppsala Univ. (Sweden). Dept. of Quaternary Geology. For primary bibliographic entry see Field 05A. W74-03285

EAGLE EYE - NEW FLOWMETER,

Dieterich Standard Corp., Boulder, Colo. Ellison Instrument Div.

K. O. Plache. Measurements and Data, Vol 7, No 5, p 104-106, September/October 1973. 3 fig, 1 tab, 4 ref.

Descriptors: \*Design, \*Flowmeters, Laboratory equipment, Instrumentation, Flow measurement.

The Eagle Eye flowmeter uses an 'Annubar' primary flow element as the flow sensor and a new indicator designed specifically for use with the sensor. Basically, the sensor transmits a pressure signal to a diaphragm which converts axial motion to the pivotal motion of a range spring. The motion to the prvotal motion of a range spring. I ne motion of the range spring is transmitted to the meter pointer by means of a permanent (stator) magnet on the range spring and a follower magnet on the pointer. Several advantages of the system are: readout is direct and close to linear; the sensor is available in sizes of 1/2 inch to 180 inches and does not require complicated engineering; pressure loss is low; accuracy and dependability are high; mea-surements can be made with dirty liquids; readings can be remote from the measurement site; and cost is competitive with those of other flowmeters.
(Little-Battelle) W74-03290

AN INEXPENSIVE, FAST RESPONSE CURRENT SPEED INDICATOR,

ce, Gloucester Point. R. J. Byrne, and J. D. Boon, III.
Chesapeake Science, Vol. 14, No 3, p 217-219,
September 1973. 4 fig, 1 tab, 2 ref.

Descriptors: \*Design, \*Costs, \*Calibrations, \*Current meters, Mechanical equipment, Electronic equipment, On-site tests, Rotating meters. Identifiers: \*Detection limits.

A low cost, fast response current speed sensor consists of a bearing supported axial rotor inside a cylindrical duct. The rotation rate of the impeller is obtained by counting the number of closures of a obtained by counting the number of closures of a magnetic proximity switch, mounted on the duct, which is actuated by the passage of small magnets bonded to the impeller. The signal is transmitted to a surface counter, a high-speed electromechanical counter and a solid state pulse generator, by the conductor suspension cable. The sensor output is linear over the calibration range of 0 to 150 cm/sec. Threshold speed is about 1.5 cm/sec. Field usage indicates the device will be useful for shallow indicates the device will be useful for shallow water applications in hydraulics and ecology. Total cost to construct the unit is estimated to be about 200 dollars. (Little-Battelle) W74-03310

NEW MULTIPARAMETER SEPARATOR
OR MICROSCOPIC PARTICLES AND

BIOLOGICAL CELLS, Los Alamos Scientific Lab., N. Mex. J. A. Steinkamp, M. J. Fulwyler, J. R. Coulter, R. D. Hiebert, and J. L. Horney. Review of Scientific Instruments, Vol 44, No 9, p 1301-1310, September 1973. 11 fig, 44 ref.

Descriptors: \*Instrumentation, Separation, techniques, \*Cytological studies, Electronic Descriptors: Instrumentation: techniques, \*Cytological studies, Electronic equipment, Data processing. Identifiers: \*Sorting, \*Staining, Counting, \*Count-ing chambers, Biological samples.

A new flow-system instrument for quantitative analysis and sorting of microscopic particles, par-ticularly biological cells, based on multiple measurements of physical and biochemical properties has been developed. Cells stained with fluorescent has been developed. Cens stamed with intorescend dyes in liquid suspension enter a unique flow chamber where electrical and optical sensors mea-sure cell volume, single- or two-color fluorescence, and light scatter, and emerge in a liquid jet that is broken into uniform droplets. Senignals are electronically processed several ways for optimum cell discrimination and are displayed as pulse-amplitude distributions using a pulse-height analyzer. Processed signals trigger cell sorting according to preselected parametric criteria. Sorting is accomplished by electrically charging droplets containing the cells and electro-statically deflecting them into collection vessels. This instrument is described in detail with illustrathis institutent is described in two lines in the two examples of experiments using polystyrene fluorescent microspheres, cultured human cells, and human leukocytes. (Little-Battelle) W74-03313

PREPARATION OF SLIDE PERIPHYTON FOR VARIOUS PRODUCTIVITY ANALYSES,

Bemidji State Coll., Minn. Dept. of Biology. D. B. Czarnecki, H. D. Williams, and E. I.

Transactions of the American Microscopical Society, Vol 92, No 2, p 284-285, April 1973. 2 ref.

# Field 07—RESOURCES DATA

# Group 7B-Data Acquisition

Descriptors: \*Periphyton, \*Primary productivity, \*Diatoms, \*Systematics, \*Methodology, \*Measurement, Chrysophyta, Biological communities, Chlorophyll, Algae.

Identifiers: Slide preparation, Sample preparation, Frustules, Recovery

An analytical procedure which employs ultrasonic vibration for the removal of diatoms from microscope slides has been used to obtain data on community chlorophyll content and diatom composition from the same sample. In this procedure the periphyton slide is placed in a polyethylene bag filled with MgCO3 saturated 90 percent acetone and the bag suspended in a vibrator filled with tap water and a small amount of wetting agent. The instrument is set at maximum cavitation for 30 min after which the bag is removed, its content poured into centrifuge tubes and centrifuged at top speed into centrituge tuees and centrituged at top speed for 10 min. Acetone solutions of the contents were analyzed for chlorophyll content. Dilutions and centrifugations of the remaining tubes yield a suspension from which the diatom frustules may be cleaned and mounted. In applying the above technique, a recovery rate of over 99 percent was maintained using slide substrates incubated over a period of 8 weeks. (Holoman-Battelle) W74-03312

A MULTISPECTRAL STUDY OF AN EX-TRATROPICAL CYCLONE WITH NIMBUS 3 MEDIUM RESOLUTION INFRARED RADIOMETER DATA.

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. For primary bibliographic entry see Field 02B. W74-03349

AN INSTRUMENTATION SYSTEM TO MEA-SURE NEAR-BOTTOM CONDITIONS ON THE CONTINENTAL SHELF, Washington Univ., Seattle. Dept. of Oceanog-

For primary bibliographic entry see Field 02J. W74-03353

TIME-INTERVAL PHOTOGRAPHY OF LIT-TORAL PHENOMENA,

Army Coastal Engineering Research Center, Washington, D.C. Engineering Development Div. For primary bibliographic entry see Field 02J. W74-03364

REMOTE SENSING IN THE STUDY OF COASTAL PROCESSES,

Army Coastal Engineering Research Center, Washington, D.C.

O. T. Magoon, and D. M. Pirie. Reprint No 17-73, Reprinted from Proceedings of Reprint No 17-13, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 115, p 2027-2042, 1972. 10 fig.

Descriptors: \*Remote sensing, \*Beaches, \*Shores, Aerial photography, Infrared radiation, Sedimentation, Water pollution, Coastal engineer-

Remote sensing was studied for use in coastal studies. The devices used were multiband photography, the infrared scanner, the Side Looking Airborne Radar, and various image enhancement and processing devices. Color produced excellent presentation of land features and limited information from sea and subsurface features. Color IR showed the size and quality of marine kelp beds but provided no way of determining whether the kelp is on the surface. The yellow wratten 12 filter on overexposed color film gave the most useful information for the analysis of current and sediment patterns. Material from sewer outfalls is clearly seen on this imagery. It also provided good water penetration. With normal exposure, red produces primarily water surface information and is thus useful in enhancement combinations. If this comation is overexposed 1 'f' stop, considera additional sedimentary information is obtained. Infrared (IR) energy can only penetrate a short distance into seawater and is highly reflected by vegetation including algae. Therefore, only the surface canopy of nearshore kelp is seen. Near-IR film is excellent for use in the analysis of waves breaking upon a beach. Since the IR film is not sensitive to a response by sediments and bottom colors, a good photograph can be obtained of coastal waves, beach cusps, and refraction patterns. (Knapp-USGS) W74-03373

COASTAL APPLICATIONS OF THE ERTS-A SATELLITE,

Army Coastal Engineering Research Center, Washington, D.C.
For primary bibliographic entry see Field 02J. W74-03374

LABORATORY INVESTIGATIONS WHITECAPS, SPRAY AND CAPILLARY

WAVES, Florida Univ., Gainesville. Coll. of Engineering. For primary bibliographic entry see Field 02E.

BACKSCATTERING FROM A TWO-SCALE ROUGH SURFACE WITH APPLICATION TO RADAR SEA RETURN,

Kansas Univ./Center for Research, Inc., Lawrence

H. L. Chan, and A. K. Fung. Available from NTIS, Springfield, Va. 22151 NASA CR-2327 Price \$3.50 printed copy (\$6.00 foreign): \$1.45 microfiche. National Aeronautics and Space Administration Contractor Report CR-2327, November 1973. 63 p, 17 fig, 1 tab, 17 ref, 7 append. NASA contract NAS 1-10048.

Descriptors: \*Remote sensing, \*Oceans, \*Surface waters, \*Surface tension, \*Radar, Reflectance, Refractivity, Model studies, Equations, Waves (Water), Ocean waves, Analytical techniques, Winds.

Identifiers: Surface scatter theory, Backscattering.

A two-scale composite sea-surface scattering theory was developed without using the non-coherent assumption. The surface is assumed electrically homogeneous and finitely conducting; the surface roughness may be nonuniform geometrically. The special forms of the terms excluding the noncoherent assumption and the meanings of these terms are discussed. To gain insight into the mechanisms of backscattering, the results are compared with those obtained by previous theo-ries. The comparison with NRL data shows satisfactory agreement for both horizontal and vertical polarization, especially for incident angles larger than 30 deg. For smaller incident angles, NASA/JSC data have been chosen for comparison, and close agreement is again observed. (Woodard-USGS) W74-03509

NON-COHERENT MODEL. FOR MICROWAVE EMISSIONS AND BACKSCAT-TERING FROM THE SEA SURFACE, Kansas Univ./Center for Research, Inc.,

Lawrence.

S. T. Wu, and A. K. Fung. Available from NTIS, Springfield, Va. 22151 NASA CR-2326 Price \$3.00 printed copy (\$5.50 foreign); S1.45 microfiche. National Aeronautics and Space Administration Contractor Report CR-2326, November 1973. 30 p, 10 fig, 24 ref. NASA Contract NAS 1-10048.

Descriptors: \*Remote sensing, \*Surface waters, \*Oceans, \*Surface tension, \*Microwaves, Reflectance, Refractivity, Ocean waves, Wind velocity, Water temperature, Forecasting, Model studies, Analytical techniques, Correlation analy-Identifiers: Backscattering, Two-scale sea sur-

The two-scale (small irregularities superimposed upon large undulations) scattering theory proposed by Semyonov has been extended and used to compute microwave apparent temperature and the backscattering cross section from ocean surfaces. The effect of the small irregularities upon the scattering characteristics of the large un-dulations is included by modifying the Fresnel reflection coefficients; whereas the effect of the large undulations upon those of the small irregularities is taken into account by averaging over the surface normals of the larte undulations. The same set of surface parameters is employed for a given wind speed to predict both the scattering and the emission characteristics at both polarizations. Improved agreement with measured results is demonstrated when compared with predictions by a single scale surface. This indicates that the sea surface is better modeled by a composite rather than a single surface. The results also imply that the adequacy of a scattering model is best exemplified when it is used to predict both the scattering and the emission characteristics. (See also W74-03509 and W74-0354) (Woodard-USGS) W74-03510

THE METEOROLOGICAL EFFECTS ON MICROWAVE APPARENT TEMPERATURES LOOKING DOWNWARD OVER A SMOOTH SEA.

Univ./Center for Research, Inc., Lawrence.

Available from NTIS, Springfield, Va. 22151 NASA CR-2325 Price \$3.00 printed copy; \$1.45 microfiche. (Foreign printed copy \$5.50). National Aeronautics and Space Administration Contractor Report CR-2325, November 1973. 33 p., 13 fig. 26 ref, 1 append. NASA Contract NAS 1-10048.

Descriptors: \*Water temperature, \*Sea water, \*Surface waters, \*Model studies, Methodology, Aircraft, Meteorological data, Rain, Clouds, Instrumentation, Absorption, Microwaves, Mathematical models. Identifiers: Smooth Sea

The effects of clouds and rain on microwave apparent temperatures for a flat sea surface are examined. The presence of clouds and rain can be expressed as a change of absorption coefficient and the total absorption is computed as the sum of individual effects. Various cloud and rain models proposed by meteorologists are employed to compute the microwave apparent temperature when viewing downward through these model at-mospheres. Stratus, cumulus, overcast, and rain all contribute significantly to the observed temperature. Larger sensitivities to clouds and rain are observed for horizontally polarized apparent temperature at large nadir angles than for vertically polarized apparent temperatre. (See also W74-03509 and W74-03510) (Woodard-USGS) W74-03511

A CONVENIENTLY CONSTRUCTED DIVISOR FOR SPLITTING LOW WATER FLOWS, Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.

D. R. Coote, and P. J. Zwerman.

Soil Sci Soc Am Proc. Vol 36, No 6, p 970-971. Identifiers: \*Divisor, Drainage, \*Flow rates, Measurement, Runoff, Splitting, \*Water flow,

Coshocton wheel.

An easily constructed divisor was designed to at-tach directly to a Coshocton wheel. It is shallow to enable it to fit under the wheel outlet. Reliability estimates are given for a range of flow rates. This escances are given for a range of flow rates. This instrument is used to obtain representative and conveniently small samples of agricultural runoff water.—Copyright 1973, Biological Abstracts, Inc. W74-03522

RADIOISOTOPIC SAND TRACER STUDY POINT CONCEPTION, CALIFORNIA.
PRELIMINARY REPORT ON ACCOMPLISHMENTS JULY 1966 - JUNE 1968,

Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 02J. W74-03608

SURFACE CHARACTERISTICS OF WIN-

Naval Postgraduate School, Monterey, Calif. For primary bibliographic entry see Field 02L. W74-03618

CIRCUIT FOR WATER DEPTH METER,

Vexilar, Inc., Minneapolis, Minn. (assignee). C. F. Bartel, Jr.

U.S. Patent No 3,764,962, 9 p, 5 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 915, No 2, p 736, October 9, 1973.

Descriptors: \*Patents, \*Water levels, Measure-ment, \*Instrumentation, Electrical equipment, ment, Depth. Identifiers: \*Water depth meters.

A depth meter for use in water is described. It has a rotating disc carrying a light emitting diode that lights up to give depth indications. The rotating disc also carries a magnet which is used to generate a signal to initiate transmission of a high frequency signal through a crystal. The crystal receives any returned signal reflected from the bottom or an object in the water. The reflected signal is amplified, and a pulse discrimination cir-cuit is used to determine if the amplified signal is acceptable. An acceptable signal trips a power cirto a light emitting diode to indicate the depth of the bottom or object causing the reflected signal. (Sinha - OEIS)
W74-03666

CONVERSION SYSTEM FOR PROVIDING USE-FUL ENERGY FROM WATER SURFACE MO-TION,

For primary bibliographic entry see Field 08C. W74-03669

A PRACTICAL METHOD OF CALCULATING POTENTIAL EVAPOTRANSPIRATION, (IN FRENCH),

For primary bibliographic entry see Field 02D. W74-03721

# 7C. Evaluation, Processing and Publication

INTEGRATED SYSTEM IDENTIFICATION AND OPTIMIZATION FOR CONJUNCTIVE USE OF GROUND AND SURFACE WATER

PHASE I, Case Western Reserve Univ., Cleveland, Ohio. Systems Engineering Div. For primary bibliographic entry see Field 02F.

W74-03201

GULLY BANK EROSION: MECHANICS AND SIMULATION BY DIGITAL COMPUTER, Iowa State Univ., Ames. Dept. of Agricultural EnFor primary bibliographic entry see Field 02J. W74-03202

ARTIFICIAL RECHARGE IN UNITED KING-DOM WITH SPECIAL REFERENCE TO LON-DON BASIN,

Water Resources Board, Reading (England). For primary bibliographic entry see Field 04B. W74-03225

INVESTIGATION OF RUNOFF OF KAMCHAT-KA RIVERS BASED ON CLIMATIC DATA (ISS-LEDOVANIYE STOKA REK KAMACHATKI PO KLIMATICHESKIM DANNYM), Adademiya Nauk SSSR, Moscow. Institut

Geografii.

For primary bibliographic entry see Field 02E. W74-03259

TWO-LEVEL SKIP-LOT SAMPLING PLANS -OPERATING CHARACTERISTIC PROPER-TIES.

Procter and Gamble Co., Cincinnati, Ohio.

R. L. Perry.
Journal of Quality Technology, Vol 5, No 4, p 160-166, October 1973. 2 fig, 2 tab. 7 ref.

Descriptors: \*Quality control, \*Sampling, Statistical methods. Identifiers: Skip lot sampling.

Skip-lot sampling plans are a system of lot-inspec-tion plans which allow skipping inspection of a fraction of the samples when the quality history shows that the product is good. The operating characteristics of three two-level skip-lot sampling plans are described. Basically the procedures involve normal inspection until a certain number of lots are accepted at which time skip-lot sampling is effected. If a given number of additional l effected. If a given number of adultional lots are accepted, a second skip-lot sampling scheme is used. If an item is rejected, the sampling procedure reverts to the original inspection scheme. The three procedures tested were compared to show the shortcomings and benefits of each. The plans can reduce the amount of inspection required when quality is good and adjust the amount of reduction according to the level of submitted quality.

ONE-WAY ANALYSIS OF VARIANCE, General Electric Co., Louisville, Ky.

W74-03291

D. M. Olsson. Journal of Quality Technology, Vol 5, No 4, p 191-193, October 1973. 1 fig, 5 ref.

Descriptors: \*Computer programs, \*Data processing. Identifiers: \*Analysis of variance.

A computer program for one-way analysis of variance is described. The advantages of the program are: (1) flexible, easy-to-use input; (2) averages and standard deviations of averages within treatment variances and residuals can be calculated: (3) analysis of variance can be tabulated and the treat ment component of variance can be estimated; and
(4) the probability of exceeding the calculated
treatment F-ratio can be provided. (Little-Battelle) W74-03292

STATISTICAL PREDICTION OF EQUILIBRI-UM TEMPERATURE FROM STANDARD METEOROLOGICAL DATA BASES,

ESL, Inc., Sunnyvale, Calif. For primary bibliographic entry see Field 05A. W74-03330

THE GENERATION OF FLOOD DAMAGE TIME SEQUENCES, Kentucky Water Resources Inst., Lexington. For primary bibliographic entry see Field 04A.

W74-03334

NUMERICAL CALCULATION OF WAVE REFRACTION DIGITAL COMPUTER, Texas A and M Univ., College Station. Coastal and Ocean Engineering Div. For primary bibliographic entry see Field 08B. W74-03343

LABORATORY FACILITY FOR STUDIES RE-LATED TO ARTIFICIAL RECHARGE, Geological Survey, Lubbock, Tex. For primary bibliographic entry see Field 04B. W74-03360

DAMS AND RESERVOIRS IN TEXAS: PART II. Texas Water Development Board, Austin. For primary bibliographic entry see Field 08A. W74-03375

AN EVALUATION OF WATER-QUALITY DATA OBTAINED AT FOUR STREAMFLOW DAILY-RECORD STATIONS IN IDAHO, Geological Survey, Boise, Idaho. For primary bibliographic entry see Field 05A. W74-03507

PROCEDURES FOR TESTING THE DIFFERENCE OF MEANS WITH INCOMPLETE

DATA, Florida State Univ., Tallahassee. Dept. of Statistics. P. E. Lin.

Journal of the American Statistical Association, Vol 68, No 343, p 699-703, September 1973. 2 tab,

Descriptors: \*Testing, \*Statistical methods, Average, Sampling, Monte Carlo method, Quality control.

Identifiers: \*Difference of means, Bivariate normal distribution, Missing data, Hypothesis testing.

Procedures for testing the difference of means are obtained in sampling from a bivariate normal distribution with covariance matrix sigma when some of the observations on one of the variables are missing. A UMP test procedure is obtained when sigma is known. When sigma is not known, exact test procedures may be obtained by discarding partial data. To make use of all available data, approximate test procedures are proposed. These procedures are compared to the exact tests, obtained by discarding partial data, using Monte Carlo methods. 9mortland-Battelle) W74-03581

PROCESSING AND ANALYSIS OF RADIOISOTOPIC SAND TRACER (RIST) STUDY DATA, Oak Ridge National Lab., Tenn. For primary bibliographic entry see Field 02J. W74-03628

THE WATER CYCLE ON A WATERSHED IN THE PALOUSE REGION OF IDAHO, Bureau of Reclamation, Fresno, Calif. For primary bibliographic entry see Field 04A. W74-03739

### 08. ENGINEERING WORKS

### 8A. Structures

MINIMUM COST DESIGN OF WATER DIS-TRIBUTION SYSTEMS,
Kentucky Water Resources Inst., Lexington.
D. J. Wood, and C. O. Charles.

#### Field 08-ENGINEERING WORKS

### Group 8A-Structures

Available from National Technical Information Service as PB-226 764; \$3.50 in paper copy, \$1.45 in microfiche. Research Report No 62, 1973. 46 p, 2 fig. 5 ref. 1 append.

Descriptors: \*Water distribution (Applied), \*Optimization, \*Piping systems (Mechanical), \*Net-work design, Economic efficiency, \*Costs, Design, Pipelines, Pressure, Flow, Dynamic programming.

The objective was to develop the analytical tools and procedures for minimum cost design of water distribution systems. Both analog and digital means of carrying out pressure and flow calcula-tions were developed. As a result of this effort, digital programs for pressure and flow calculations in water distribution systems were written and have been widely distributed to practicing engineers. One procedure is based on a direct solution of the basic system equations using a linearization scheme and has several advantages over conventional techniques such as the Hardy Cross method. These include avoiding the need to initially balance the network and an assured convergence of the procedure. Using this tool a procedure was developed for selecting pipe diameter which will result in a minimum cost design within the prescibed constraints. The method of steepest ascent and dynamic programming concepts were used to carry out the optimization. This procedure applies to closed loop systems without internal pumping. This work provides a basis for extending the concepts to more generalized water distribution systems. (Grieves - Kentucky) W74-03205

# STATE OF GROIN DESIGN AND EFFECTIVE-

NESS, Army Coastal Engineering Research Center, Washington, D.C. Evaluation Branch. J. H. Balsillie, and D. W. Berg. Reprint No 15-73, Reprinted from Proceedings of

13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 75, p 1367-1383, 1972. 1 fig, 47 ref.

Descriptors: \*Groins (Structures), \*Coastal engineering, Littoral drift, Sedimentation, Sediment control, Beach erosion, Beaches, Coastal engineering.

A review of functional design criteria includes groin length, height, spacing, permeability-ad-justability, and orientation. Coastal processes and their relationship to groin design and effectiveness are also discussed. As a general rule, groins should not be built where there are inadequate supplies of longshore moving drift; where supplies are in-adequate, artificial fill should be used either independently or in conjunction with groins. (Knapp-USGS) W74-03370

# DAMS AND RESERVOIRS IN TEXAS: PART II,

Texas Water Development Board, Austin.
C. L. Dowell, and R. G. Petty.
Texas Water Development Board Report 126, November 1973, 329 p.

Descriptors: \*Dams, \*Reservoirs, \*Dam design, \*Texas, Hydraulic structures, Hydraulic properties, Damsites, Dam construction, Dam founda-

tions, Aerial photography. Identifiers: \*Trinity River basin (Tex), \*San Jacinto River basin (Tex), \*Brazos River basin (Tex).

Documentation is presented, where possible, concerning structural details, hydraulic charac-teristics, tables of general information, and photographs of all dams and reservoirs with 5,000 acrefeet or more capacity located in Texas. In order to have a convenient size, the report is printed in three parts. This part, Part II, includes projects

completed or in progress as of October 31, 1972, in the Trinity, San Jacinto, and Brazos River basins and the adjoining coastal basins. The data sheets were prepared from the best available information, including Texas Water Development Board Report 48, the Texas Water Rights Commission files, the Texas Water Development Board files, the project owners, and the consulting engineers The sheets were then presented to the project owners for approval before printing. (Woodard-W74-03375

#### AMERICAN FALLS DAM, UPPER SNAKE RIVER PROJECT, IDAHO.

For primary bibliographic entry see Field 06E. W74-03419

# THE EFFECTS OF WATER CONSERVATION WORKS ON THE REGIME OF MORECAMBE

Hydraulics Research Station, Wallingford, (England). For primary bibliographic entry see Field 04A. W74-03483

### 8B. Hydraulics

#### MINIMUM COST DESIGN OF WATER DIS-TRIBUTION SYSTEMS,

Kentucky Water Resources Inst., Lexington. For primary bibliographic entry see Field 08A. W74-03205

# TIDAL INLETS FOR PRESERVATION OF

ESTUARIES, Lockwood, Andrews and Newnam, Inc., For primary bibliographic entry see Field 02L. W74-03342

#### NUMERICAL CALCULATION OF REFRACTION DIGITAL COMPUTER,

Texas A and M Univ., College Station. Coastal and Ocean Engineering Div. T. E. Orr, and J. B. Herbich.

Available from NTIS as PB-190 657, for \$6.00 paper copy, \$1.45 microfiche. Sea Grant Publica-tion No 209, COE Report No 114, December 1969. 79 p, 27 fig, 4 tab, 15 ref, 3 append. Grant GH-29.

Descriptors: \*Coastal structures, \*Waves (Water), \*Shallow water, \*Refraction (Water waves), Mathematical models, Digital computers, \*Computer programs.
Identifiers: Shoaling, Bottom topography

Recent developments in methods for analysis of offshore structures warrant refining the calculation of wave forces that will act on the structures. Wave height is one of the prime criteria required to obtain an accurate estimate of these forces: therefore, it is imperative that the engineer be able to predict the wave height as closely as possible. In shoaling waters refraction affects the wave height significantly and can either increase it or decrease it. LePetit of the Laboratoire National d'Hydraulique in France has proposed a method for calculating wave refraction using numerical methods. A computer program was developed based on LePetit's method and a number of refraction patterns were obtained for waves passing over a region of complex hydrography. These refraction patterns were compared to patterns obtained using graphical methods. The computer solutions were found to be faster to plot and more responsive to hydrographical changes close to the shoreline.
(Sinha-OEIS) W74-03343

# MAXIMUM BREAKER HEIGHT FOR DESIGN, Army Coastal Engineering Research Center, Washington, D.C.

J. R. Weggel. Reprint No 8-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 21, p 419-432, 1972. 6 fig, 15 ref, append.

Descriptors: \*Waves (Water), \*Surf, \*Coastal engineering, Equations, Coastal structures. Identifiers: Waves (Breaking).

The re-evaluation of previously published breaking wave data was used to develop a relationship for the maximum breaker height in terms of the depth in which the wave breaks, breaker steep-ness, and the local beach slope. This relationship is used with breaker travel distance to estimate the maximum breaker height to which a coastal structure might be subjected. In addition, the range of depths in which a wave of given height will break may be found by examination of the upper bound of observed values of db/Hb. An example problem is presented to illustrate the use of the general maximum breaker height design curves. (Knapp-W74-03363

#### CHARACTER AND STABILITY OF A NATU-RAL TIDAL INLET,

Army Coastal Engineering Research Center, Washington, D.C. For primary bibliographic entry see Field 02L. W74-03365

# CASE HISTORY OF MISSION BAY INLET, SAN

DIEGO, CALIFORNIA, Moffat and Nichols, Long Beach, Calif.

W. J. Herron, Jr. Reprint No 11-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 43, p 801-821, 1972. 4 fig, 1 tab, 13 ref.

Descriptors: \*Coastal engineering, \*Inlets (Waterways), \*Scour, \*Sedimentation, Silting, Sediment transport, Littoral drift, Waves (Water), Currents (Water), Jetties, Coastal structures, \*California. Identifiers: Mission Bay (Calif).

The Mission Bay Inlet was designed as a nonscouring entrance channel by the Corps of Engineers in 1946. A channel with over twice the cross sectional area required by the O'Brien equa-tion was developed to reduce the average cross sectional tidal currents to less than two feet second. The design depth of -20 feet MLLW eliminated bottom movement induced by wave action, except during the most severe storms. The jetties are sealed to the +4 foot elevation and extend to the -25 foot depth almost entirely eliminat-ing the intrusion of littoral drift. The channel has shoaled at a rate of less than 20,000 cubic yards per year since final dredging in 1959, indicating the soundness of this concept. (Knapp-USGS) W74-03366

# STATE OF GROIN DESIGN AND EFFECTIVE.

NESS, Army Coastal Engineering Research Center, Washington, D.C. Evaluation Branch. For primary bibliographic entry see Field 08A. W74-03370

### WAVE RUNUP ON VERTICAL CYLINDERS.

Army Coastal Engineering Research Center, Washington, D.C. Coastal Processes Branch. C. J. Galvin, and R. J. Hallermeier.
Reprint No 19-73, Reprinted from Proceedings of 13th Coastal Engineering Conference, July 10-14, 1972, Vancouver, B. C., Canada: American Society of Civil Engineers Publication, Chapter 111, p 1955-1974, 1972. 14 fig, 2 tab, 21 ref.

Descriptors: \*Waves (Water), \*Piers, Piles (Foundations) Coastal engineering.

Wave height at a point on vertical cylinders is a function of the orientation angle between the nor mal from the point and the direction of travel of a single periodic train of waves. The wave height distribution has a broad maximum around 0 deg (facing into the waves) and a more restricted maximum at 180 deg. The maximum at 0 deg increases with wave height in all cases, and the superelevation has about the magnitude of the velocity head in the wave crest. Most of the variation in height is due to variation in crest elevation; trough elevation remains relatively constant. The shape of the wave height distribution depends more on height and cylinder cross section than on period, although the variation as a function of cross sec tion is significantly less than the extreme variations in tested cross sections. Applications of these results to wave direction measurement and to interpretation of wave records from surfacepiercing wave gages are discussed. (Knapp-USGS) W74-03372

TIDAL RESONANCE IN THE BAY OF FUNDY

AND GULF OF MAINE, Dalhousie Univ., Halifax (Nova Scotia). Inst. of

Oceanography. For primary bibliographic entry see Field 02L. W74-03434

ORBITAL VELOCITY ASSOCIATED WITH WAVE ACTION NEAR THE BREAKER ZONE, Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 02J. W74-03444

INVESTIGATIONS LABORATORY WHITECAPS, SPRAY AND CAPILLARY

WAVES, Florida Univ., Gainesville. Coll. of Engineering. For primary bibliographic entry see Field 02E. W74-03506

BED FORMS GENERATED IN THE LABORA-TORY UNDER AN OSCILLATORY FLOW: ANALYTICAL AND EXPERIMENTAL STUDY, Army Coastal Engineering Research Center, Washington, D.C.

M. R. Carstens, F. M. Neilson, and H. D.

Technical Memorandum No. 28, June 1969. 105 p, 24 fig, 12 tab, 23 ref, 2 append. DA-149-055CIVENG-65-1.

Descriptors: Flow, Sands, \*Sediment transport, \*Beds under water, \*Dunes, \*Waves (Water). Identifiers: \*Oscillatory flow, Alluvial channels, Drag coefficients.

The purpose was to study experimentally bedforms in a bed of uniform sand in an oscillatory-flow water tunnel. Experiments were organized to study incipient motion evolution of a duned bed, geometry of equilibrium dunes, and energy dissipation in the flow over a duned bed. The in-cipient-motion condition, on both a duned and flat bed, was analyzed by considering lift, drag, and submerged weight forces on a typical surface par-ticle. An analytical expression was derived for the critical velocity. Rational expressions were derived for the widely used Shields diagram which is based on experimental findings. The evolution of a flat bed into a duned bed was observed. A ripple system forms spontaneously all over the bed if the maximum velocity is greater than the critical

velocity. Geometry of equilibrium dunes was determined from side-elevation photographs and point-gage traverses over the bed. The ratios of dune amplitude to dune wave length were foun be unique functions of a single variable - ratio of be unique runctions of a single variable - ratio of water motion amplitude to mean particle diameter. The added energy dissipation with oscillatory flow over a duned bed was compared with oscillatory flow over a smooth flat bed by measurement of work input into the tunnel. Results were presented in terms of difference in boundary-drag coeffi-cients between the duned and smooth bed. The magnitude of such coefficients is greatly inenced by the choice of a reference velocity. A velocity in the vicinity of the bed deformation is a more rational reference than a velocity far from the bed such as the mean velocity in unidirectional flow. (Sinha-OEIS)

PILOT MODEL STUDY FOR THE DESIGN OF HILO HARBOR TSUNAMI MODEL. HYDRAU-LIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

Available from NTIS as AD-646 501, for \$6.00 paper copy, \$1.45 microfiche. Research Report No. 2-3, March 1965. 67 p, 25 fig, 3 tab, 6 ref, 3 ap-

Descriptors: "Hawaii, Model studies, "Waves (Water), "Tsunamis, "Bores, "Harbors, Bays, Coasts, "Resonance, Hydraulic models. Identifiers: Hilo Harbor (HI), Wave generators, Wave absorbers.

Tests were conducted on a pilot model of Hilo Bay to determine whether distortion of scales was appropriate for a tsunami model. The test results showed that a distortion of factor of three had negligible effect on the amplification factor and lo-cation of bores within the bay. The tests also showed that a resonant model ocean area was not required for proper generation of the bores. A sim-ple size and fall of water surface at the bay mouth created a strong wave amplification within the bay if the period of oscillation was near that computed for resonant response of the bay. This period de-pends only on the geometry of the bay. Absorbers can be used between the wave generator and the bay mouth to reduce re-reflected waves; thus, the wave generator can be positioned quite close to the bay mouth. Three memoranda by Keulegan, giving theoretical developments in tsunami model design, are appended. (Sinha-OEIS)

A MODEL STUDY OF THE ENTRANCE CHAN-

NEL DEPOE BAY, OREGON, Army Coastal Engineering Research Center, Washington, D.C. J. P. Ahrens.

Available from NTIS as AD-662 000, for \$6.00 paper copy, \$1.45 microfiche. Technical Memorandum No. 23, September 1967. 25 p, 12

Descriptors: \*Oregon, Harbors, \*Coasts, \*Bays, Channels, \*Waves (Water), Energy, Model stu-dies, Hydraulic models.

Identifiers: Depoe Bay (Or), \*Wave action, \*Wave

A scale model study was conducted to see if a proposed widening of the entrance channel at Depoe Bay, Oregon would allow appreciably more wave energy to enter the harbor area. A linear, undistorted Froude Scale of 1 to 120 was used. The model was constructed of mortar in a wave tank 72 feet long and 1.5 feet wide, with a stillwater depth of about 1.0 foot in the deeper area beyond the harbor entrance. Ponding in the model bay due to wave action was noted, and in extreme cases exceeded the equivalent of 5 feet prototype. The wave height transmission coefficient for the waves traveling from offshore through the channel and into the bay ranged from greater than 1.0 for long waves to less than 0.1 for short waves. (Sinha-OEIS)

WIND DRIVEN WATER CURRENTS.

Toronto Univ. (Ontario). Dept. of Mechanical Engineering. W. D. Baines, and D. J. Knapp.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 91, No HY2, Pt 1, Proceedings Paper 4270, p 205-221, March 1965. 8

Descriptors: \*Coasts, \*Beaches, \*Wind pressure, \*Shear stress, Turbulent flow, Channel flow, Dispersion, \*Currents (Water).

Identifiers: Wind driven currents, Air-sea interaction, Bottom slope, Transverse boundaries, Water

A large body of water is considered over which a flow of air produces a shear stress; the water is otherwise undisturbed. For the two-dimensional case, this flow of air results in a surface current in the direction of the wind and a return current near the bed. From dimensional analysis, it is shown that the shear velocity for the free surface is the basic parameter for dynamic similarity in turbulent flow. Such characteristics as the ratio of surface velocity to shear velocity and the ratio of surface bed stresses are functions only of the Reynolds number based on shear velocity. A series of experiments were conducted in which the mean flow and turbulence properties were mea-sured in a channel of uniform depth. The distribu-tion of mean velocity was found to be similar to jets at both the surface and the bed, with a relatively static central region. Intensity of turbulence is high and almost uniform across the central region. Dispersion of material in the flow is consequently large although net transport is not. Ex-periments were also conducted with either a beach or a lateral contraction at the downwind end of the channel. Over the beach there was an appreciable velocity change in the wind direction only near the shoreline. The lateral constriction introduced secondary flow. (Sinha-OEIS)

SURVEY OF GULF COAST STRUCTURAL DAMAGE RESULTING FROM HURRICANE CAMILLE, AUGUST 1969,

neer Waterways Experiment Station, Army Engir Vicksburg, Miss.

VICKSDUTG, MISS.
M. E. Crisewell, and R. S. Cummins.
Available from NTIS as AD-707 941, for \$3.00 paper copy, \$1.45 microfiche. Technical Report N-70-10, April 1970. 154 p, 116 fig, 4 ref. DAHC20-68-W-0192.

Descriptors: Mississippi, Louisiana, \*Hurricanes, Storms, \*Wind tides, Structures, Damages, \*Ero-

Identifiers: Gulfport (Miss), Hurricane Camille (August 1969).

The damage to structures is described as seen by an inspection team sent to the Mississippi and an inspection team sent to the Mississippi and Louisiana Gulf Coast regions after Hurricane Camille, a very violent but relatively small tropical storm, came ashore west of Gulfport, Mississippi, late on 17 August 1969. Many photographs of the storm damage are included. Extensive damage resulted both from the unusually high winds ac-companying Camille and from the extremely high tides coupled with wind-driven waves. Damage was greatest in low areas immediately adjacent to the coastline. Because of uncertainties of the material properties for the various buildings and particularly of the loading, qualitative results are presented. More ductile buildings, such as heavy wooden frame construction, appeared to have sur-

# Field 08-ENGINEERING WORKS

# Group 8B-Hydraulics

vived the storm best. The storm damage indicated a need for more lateral strength in buildings, especially masonry structures, and for more adequate design of connections and other details. (Sinha - OEIS) W74-03623

WINDS, WIND SET-UPS, AND SEICHES ON LAKE ERIE, United States Lake Survey, Detroit, Mich.

I. A. Hunt, Jr.

Available from NTIS as AD-692 800 for \$6.00 paper copy, \$1.45 microfiche. Technical Report No 1-2, January 1959. 59 p, 23 fig, 6 tab, 9 ref.

Descriptors: \*Shore protection, Harbors, \*Water Wind. \*Seiches, \*Coasts, levels, \*Lake Erie, Wind, \*Seiches, \*Surges, \*Forecasting, New York. Identifiers: \*Atmospheric stability, Wind set-ups, Niagara River.

The prediction of storm water levels on Lake Erie caused by high winds is becoming increasingly im-portant. Engineers must know expected water levels to design harbor improvements and shore protective works. Masters of lake vessels must know the expected variations in water levels to navigate with safety. A knowledge of surges in the Niagara River caused by water level fluctuation is of vital importance to the power entities at Niagara Falls. Lake Erie, the shallowest of all the Great Lakes with an average depth of some 58 feet, has appreciable wind set-ups and presents a challeng-ing problem. Certain factors are described which have not been discussed adequately in previous dissertations concerning winds, wind set-ups, and seiches on Lake Erie. These factors include the importance of atmospheric stability in determining the over-water wind speeds; the effect that Pelee Point and the islands in the western end of the lake have on the flow of displaced water; and the effects which seiches and local disturbances have on the water levels recorded at the gaging sites. Also, a simple, accurate method of forecasting the water level rise at Buffalo is given. (Sinha - OEIS)

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966, VOLUME I.

American Society of Civil Engineers, New York, Vol 1, Parts 1 and 2, p 1-789, J. W. Johnson, editor 1967. Price: \$12.00/2 vol.

Descriptors: Waves, Sediments, Energy transfer, Wind, Shallow water, Coastal structures, Breakers, Surf, Coasts, Sediment transport, Sedimentation, Coasts, Littoral drift, Conferences. Identifiers: Wind waves, Wave action.

This is the first of two volumes of papers which constitute the proceedings of the Tenth Conference on Coastal Engineering held in Tokyo, September 1966. It contains papers on studies on theoretical and observed wave characteristics and coastal sediment problems. In remarks at the opening session M. P. O'Brien suggested that the proceedings of these conferences form an encyclopedia of theory, laboratory studies, field observations, design methods, case histories in coastal morphology, and in the lore and knowledge characteristic of an active phase of engineering practice. (See W74-03675 thru W74-03699) (Sinha -OEIS) W74-03674

NUMERICAL CALCULATION OF WIND WAVES IN SHALLOW WATER, Kyushu Univ., Fukuoka (Japan). Dept. of Hydrau-

It. Civil Engineering.
T. Ijima, and F. L. W. Tang.
In: Proceedings of Tenth Conference on Coastal
Engineering, Tokyo, Japan, September 1966,

American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 4, p 38-49, 1967. 10 fig, 4 ref.

Descriptors: \*Shallow water. \*Waves (Water). Typhoons, Refraction (Water waves), Graphical analysis, Numerical analysis, Fetch, Continental shelf, Forecasting, Coasts. Identifiers: \*Wind waves, Taiwan, Hindcasting, Inland seas.

Numerical calculations of wind waves in shallow water are preferable over the use of graphical methods. Wilson's numerical integration method was extended for use in the calculation of the waves in shallow water. Proposed relationships governing wave generation in shallow water, effect of wave refraction and the forecasting and hindcasting of waves in typhoons are set forth as illustrations of the numerical analyses. (See also W74-03674) (Sinha - OEIS) W74-03675

OBSERVATIONS OF THE TRANSFORMATION OF OCEAN WAVE CHARACTERISTICS NEAR COASTS BY USE OF ANCHORED BUOYS,

Kyoto Univ. (Japan). Disasters Prevention Research Inst.

H. Higuchi, and T. Kakinuma.

In: Proceedings of Tenth Conference on Coastal Engineering Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 7, p 77-98, 1967. 10 fig, 2 tab, 5

Descriptors: \*Waves (Water), \*Shallow water, \*Coasts, Photography, \*Buoys, Ocean waves. Identifiers: Japan, \*Long waves, \*Wave transfor-

To study wave transformation in shallow water a series of wave observations were carried out along some coasts in Japan by photographing two or three convenient buoys aligned in the direction of the waves with two 16 mm cine-cameras. The equipment and methods used in observations and analyses are described together with some of the results obtained. By examining the motion of the buoys off the coast at Shirahama it was found that the method of wave observation by means of anchored buoys was very useful in the case of comparatively long waves. (See also W74-03674) (Sinha - OFIS) W74-03676

RESPONSE CHARACTERISTICS OF UN-DERWATER WAVE GUIDE,
Tokyo Univ. (Japan). Dept. of Civil Engineering.

M. Hom-ma, K. Horikawa, and S. Komori. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 8, p 99-114, 1967. 11 fig, 3 tab,

Descriptors: Underwater, Surface water, \*Instrumentation, Water levels, \*Shallow water, \*Ocean

Identifiers: \*Japan (Ohita coast), Wave gages, Correction factor, \*Water depth, Progressive waves, Wave pressure, Nearshore, \*Wave spec-

Characteristics are discussed of the correction factor introduced into the relationship between the water surface elevation of progressive waves and its corresponding fluctuation of underwater wave pressure. As a result of extensive investigations conducted both in laboratory and field, it is verified that the correction factor is well expressed by a certain function of relative water depth. By using an empirical formula proposed the power spectrum of surface elevation and its sigwave height off the Ohita Coast are estimated from the record of underwater pressure fluctuation. The estimated values, generally

speaking, are in satisfactory agreement with the actual ones determined from the records of surface water elevation. (See also W74-03674) (Sinha - OFIS)

WAVE BOUNDARY LAYERS AND FRICTION

FACTORS, Technical Univ. of Denmark, Copenhagen. Coastal Engineering Lab. I. G. Jonsson.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 10, p 127-148, 1967. 6 fig, 37

Descriptors: \*Coasts, \*Waves (Water), \*Friction, \*Boundary layers, \*Flow characteristics, Descriptors: Coasse, \*Flow characteristics, \*Forecasting, Energy loss.

Identifiers: Nearshore, Wave boundary layer, Bottom friction, Roughness,

An attempt is made to re-evaluate and systematize the many observations and the rather few detailed measurements of the phenomena of wave height damping due to bottom friction. In nature the wave boundary layer will always be rough turbulent. This is not necessarily the case in a hydraulic model. The aim is therefore to make it possible to determine the proper flow regime for a pure short-period wave motion over a given bed. Values for the wave friction factor and the wave boundary layer thickness are also proposed. The main results of the study are presented in three diagrams giving flow regimes, friction factors and boundary layer thicknesses. (See also W74-03674) (Sinha - OEIS) W74-03678

LAMINAR DAMPING OF OSCILLATORY WAVES DUE TO BOTTOM FRICTION, Kyoto Univ. (Japan). Disasters Prevention

Research Inst.

Y. Iwagaki, and Y. Tsuchiya. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 11, p 149-174, 1967. 7 fig, 2 tab,

Descriptors: \*Waves (Water), \*Boundary layers, Shear stress, Convection, \*Shallow water. Identifiers: \*Oscillatory waves, \*Bottom friction, \*Airy waves, Laminar damping, Wave damping.

The purpose is to discover the mechanism of the laminar damping of oscillatory waves due to bot-tom friction with the aid of the theory of the laminar boundary layer due to waves and of the measurements of instantaneous shearing stresses exerted on a smooth bottom, resulting from wave motion and wave amplitude attenuation with distance. In a theoretical approach the effects of convective terms involved in the basic equations of laminar boundary layers developing both on the bottom and the side walls of a wave channel are considered on the basis of an approximate solution of the equation, and a theory of the laminar damp-ing of Airy waves is established. In experimental studies, furthermore, direct measurements of instantaneous stresses and observations of wave amplitude attenuation were performed, and the experimental results are compared with both the above theory and the linearized one. (See also W74-03674) (Sinha - OEIS) W74-03679

DIFFRACTION OF WIND GENERATED WATER WAVES. Suez Canal Authority Research Center, Ismailia

(Egypt). I. E. Mobarek, and R. L. Wiegel.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japuberra)tember 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 13, p 185-206, 1967. 10 fig, 4 tab, 17 ref.

Descriptors: \*Coasts, \*Waves (Water), \*Breakwaters, "Harbors.
Identifiers: "Wind waves, "Wind generated waves, Diffraction, Wave spectra, Energy spec-

In designing a harbor an engineer must consider the diffraction of waves. In most studies, only uniform periodic waves coming from a singl direction are treated. However, wind generated waves in the ocean are two dimensional, and the diffraction of waves due to a breakwater should be treated with this in mind. As methods of measuring the two-dimensional spectra of waves were developed recently, it was decided to determine whether or not diffraction theory could be applied with sufficient accuracy for two-dimensional wave spectra. The results of a laboratory study presented herein show that a knowledge of the two-dimensional spectra can be used together with diffraction theory to predict the enrgy spectra of waves in the lee of a breakwater within an accuracy that is probably acceptable for many engineering problems. There is a strong evidence support-ing the assumption of linearity in the theory of diffraction - as far as many practical considerations are concernced. The diffraction theory can be applied, for some practical purposes, to the two-dimensional spectrum at a harbor entrance to calculate the energy level at the various points inside the harbor. (See also W74-03674) (Sinha - OEIS) W74-03680

# A POSSIBILITY OF GENERATION OF SURF

Tokai Univ., Tokyo (Japan). Coll. of Marine Science and Technology. S. Unoki, and I. Isozaki.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 14, p 207-216, 1967. 6 fig. 8 ref.

Descriptors: \*Coasts, \*Shores, Waves (Water), \*Surf, \*Shallow water, Sea level, \*Bays. Identifiers: Swell, Surf beats, Long waves, Shoreline configuration, Oscillations, Bottom topography, "Wave height, Wave period.

Indentations of a shoreline or irregularities of the sea bottom form a small oscillating system of water. When the period of natural oscillation is near that of advancing sea waves a forced standing oscillation develops there, accompanied by an uneven mean surface level of the second order. If the height of the sea waves varies slowly with time, the mean surface fluctuates with the period the same as that of the envelope of the sea waves, and such fluctuation will be sent back offshore as a surf beat when it is released by breaking of the original sea waves. The generated long wave seems to be correlated positively or negatively with the envelope of the sea waves, depending on the topography of the basin and the period of the incident sea waves. A possibility of generation of similar long waves in front of a breakwater or a steep beach is also suggested. (See also W74-03674) (Sinha-OEIS) W74-03681

#### A STUDY ON WAVE TRANSFORMATION IN-SIDE SURF ZONE,

Tokyo Univ. (Japan). Dept. of Civil Engineering. K. Horikawa, and C-T. Kuo.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 15, p 217-233, 1967. 11 fig, 2 Descriptors: Surf, \*Waves (Water), \*Shallow water, Profiles, \*Beaches, Graphical analysis, Nu-merical analysis, Energy loss, Turbulence, Slopes, \*Coasts.

Identifiers: Surf zone, \*Wave transformation, \*Wave height, Bottom friction, Bottom slope.

Wave transformation inside the surf zone is treated analytically under several appropriate assumptions. The theoretical curves computed numerically have a consistent agreement with the experimental data in the case of wave transformation on a horizontal bottom. On the other hand, in the case of wave transformation on a uniformly sloping beach, the analytical treatment seems to be inadequate to clarify the actual phenomena. Data on wave height attenuation are presented in graphic form. (See also W74-03674) (Sinha-OEIS)

#### WAVE DECAYING DUE TO BREAKING,

Ministry of Agriculture and Forestry, Hiratsuka (Japan). Agricultural Engineering Research Sta-

M. Nakamura, H. Shiraishi, and Y. Sasaki. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 16, p 234-253, 1967. 28 fig, 2

Descriptors: \*Waves (Water), \*Shallow water. Identifiers: \*Breaker zone, \*Wave height, \*Wave transformation, Wave decay, Wave length, Wave period, Wave characteristics, \*Water depth, Breaking waves.

In this study of wave characteristics at a breaking point consideration is given to wave height, length, period and water depth. The width of the breaker zone, and wave transformation according to changes in water depth are discussed. It is concluded that wave transformation from the deep sea to the shoreline can be estimated by involving the repeated breaking of waves approaching shore. (See also W74-03674) (Sinha-OEIS) W74-03683

# SHOCK PRESSURE OF BREAKING WAVE,

Research Institute for Applied Mechanics, Fukuoka (Japan).

H. Mitsuyasu. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 18, p 268-283, 1967. 5 fig, 1 tab,

Descriptors: \*Shallow water, \*Waves (Water), \*Coasts.

Identifiers: \*Shock pressure, \*Air cushion, \*Breaking waves, Wave pressures, Compression.

Shock pressure due to breaking waves was studied experimentally and analytically for the case of two-dimensional regular oscillatory waves. Importwo-timensional regular oscillatory waves. Impor-tant characteristics of shock pressures are described, which were obtained by using the newly designed pressure gauges of very high frequency responses. And the following points are examined: (1) the detailed characteristics of pressure-time histories of shock pressures, and (2) the similarity of pressure-time histories observed simultaneously with two separated gauges. The dynamic models representing the generation mechanism of shock pressure are examined to explain the observed properties of shock pressure, in which the new air-cushion model extended from the original air-cushion model of Bagnold (1939) is included. Under the assumption of small compression of the air cushion, the analytical solutions representing the pressure-time histories are obtained both for the original model of Bagnold (1939) and for the new model. For the cases of relatively high-intensity shock pressure, con-sistent results were obtained by analyzing the observed shock pressures by the new air-cushion model. A discussion of shock pressure due to finite compression of air cushion is included. (See also W74-03674) (Sinha-OEIS) W74-03684

# THE SHOALING, BREAKING AND RUNUP OF THE SOLITARY WAVE ON IMPERMEABLE

ROUGH SLOPES, Hokkaido Univ., Sapporo (Japan). Dept. of Civil

Engineering. T. Kishi, and H. Saeki.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 21, p 322-348, 1967. 19 fig, 2

Descriptors: \*Shallow water, \*Waves (Water), Shore protection, Tsunamis, \*Coasts, Bores. Identifiers: \*Solitary waves, \*Shoaling, \*Breaking waves, Wave characteristics, Wave height, Plunge

Variations in wave characteristics of solitary waves in shoaling water are discussed. The transition of wave character from the solitary wave to the bore is basic to the understanding of the problem. Experimental curves representing transformation of wave height prior to breaki well as the curves giving the breaker conditions are presented. Theories for the transformation of wave height after breaking and the prediction of the plunge point are presented and compared favorably with the laboratory measurements. Runup heights and wave quantities at the shoreline are measured to compare with the theory of a bore on a dry bed. (See also W74-03674) (Sinha-OEIS) W74-03685

#### RUNUP RECIPE FOR PERIODIC WAVES ON UNIFORMLY SLOPING BEACHES,

Scripps Institution of Oceanography, La Jolla, Calif.

W. G. Van Dorn.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 22, p 349-363, 1967. 7 fig. 5 ref.

Descriptors: \*Waves (Water), \*Shallow water, \*Beaches, Slopes, Coasts.
Identifiers: \*Wave runup, \*Periodic waves, \*Shoaling, Nomographs, Prediction.

The shoaling enhancement of small-amplitude, dispersive wave trains traveling over uniform, im-permeable slopes was observed in a specially-constructed wave channel, where the reprodu wave elevation measurement accuracy was about .0005-in. These observations substantially support the enhancement predicted from linear theory (conservation of energy flux) except in very shallow water and on very steep slopes, where accelerative effects become important. On the hypothesis that small-amplitude runup theory ght be similarly valid for periodic waves of finite height, provided that the positive incident wave amplitude is replaced by the local crest height above still water, this theory was modified to include the effect of the superelevation under a wave crest due to profile asymmetry. The modified theory is shown to agree acceptably with runup observations of larger waves previously reported - both for breaking and non-breaking waves. Because solutions to the modified theory cannot conveniently be obtained by manual calculation, a nomograph chart is included, from which runup predictions can be easily made, given only the wave height, period, and water depth a wavelength or so from shore, and the beach slope. (See also W74-03674) (Sinha-OEIS) W74-03686

# Field 08—ENGINEERING WORKS

# Group 8B-Hydraulics

TRANSFORMATION OF SURGES.

Osaka Univ. (Japan). Dept. of Civil Engineering. A. Murota.

A. Mutous.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 24, p 382-395, 1967. 12 fig, 9

Descriptors: \*Waves (Water), \*Surges, \*Bores, \*Shallow water.
Identifiers: \*Breaking waves, \*Wave transforma-

tion. Periodic waves, Dispersive waves.

The transient deformation of surges (bores) is discussed. Ideal surges in open channels would normally disperse into periodic waves and be transformed to the undular bore. A train of these dispersive waves may finally reach some stable form e.g. solitary or cnoidal waves. In the transient process, with the development of the undulations. the height of the initial wave would not be constant as has been suggested by Keulegan-Patterson (1940), but would fluctuate in a complicated manner. Regions in which wave crests or troughs can exist are indicated and experimental criteria by which modes of breaking (spilling, surging or plunging) can be determined are listed. The curvature of the wave surface plays a leading role in the mechanism of dispersion and may act as a convective agent in the development of the undulation. (See also W74-03674) (Sinha-OEIS) W74-03687

ON A COEXISTENCE SYSTEM OF FLOW AND

WAVES, Kobe Univ. (Japan). Dept. of Civil Engineering. J. Matsunashi.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 26, p418-433, 1967. 3 fig, 5 ref.

Descriptors: Estuaries, \*Fluid flow, \*Waves (Water), Equations, \*Open channel flow, (Water), Equations, Mechanical properties.

Identifiers: Bottom friction, Bottom topography, \*Oscillation

The problem of the 'coexistence system' in the case when the forced oscillation of the water surface is superposed on the open channel flow over a fixed bed is discussed. The mechanical properties of the reciprocal action between flow and waves are examined theoretically and experimentally. (See also W74-03674) (Sinha-OEIS) W74-03688

MODEL STUDIES OF IMPULSIVELY-GENERATED WATER WAVES.

Hawaii Univ., Honolulu. Dept. of Civil Engineering. J. M. Jordaan, Jr.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 1, Chap 27, p 434-454, 1967. 8 fig, 2 tab,

Descriptors: \*Waves (Water), \*Earthquakes, \*Explosions, Model studies.

Identifiers: \*Underwater explosions, Slides, Dispersive waves.

The wave action due to a sudden impulse in a body of water was studied in a wave basin with beach in the laboratory. Waves were impulsively generated in the 90 ft tank of water, 3 ft. deep, by the impact or sudden withdrawal of a paraboloidal plunger 14 ft. in diameter. The waves had a dominant height of 2 inches and period of 3 seconds, respectively, at a distance of 50 ft. from the plunger. Such waves are scale representations of those generated by sudden impulses in the ocean, such as an un-derwater nuclear explosion, a sudden change in the ocean bed due to earthquakes, or the impact of a land slide. The waves produced by a downward impulse, or by an underwater explosion, form a dispersive system: whose properties are not constant as in a uniform progressive wave train. Wave periodicities, celerities and wave lengths increase with time of travel and wave heights decrease with travel distance. A theory was developed to predict the wave properties at a given travel time and distance for given source energy, displacement and travel path depth profile (Jordaan 1965). Measurements agree fairly well with prediction. (See also W74-03674) (Sinha-OEIS) W74-03689

SEDIMENT TRANSPORT AND ACCRETION AROUND THE COASTLINES OF JAPAN, Western Australia Univ., Nedlands. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02L.

MODEL STUDY ON THE FILLING-UP OF A FISHERY HARBOR BY DRIFTING SAND, Kyoto Univ. (Japan). Disasters Prevention Kyoto Univ. Research Inst. For primary bibliographic entry see Field 02L.

A PETROGRAPHIC STUDY ON LITTORAL DRIFT ALONG THE ISHIKAWA COAST,

JAPAN, Senshu Univ., Tokyo (Japan). For primary bibliographic entry see Field 02L. W74-03692

W74-03691

TRANSPORT PATTERNS IN THE CHAO PHYA ESTUARY Waterloopkundig Laboratorium, Delft (Nether-

For primary bibliographic entry see Field 02L. W74-03693

LITTORAL BYPASSING AND BEACH RESTORATION IN THE VICINITY OF PORT HUENEME CALIFORNIA, Program Engineer District, Los Angeles, Calif.

Army Engineer District, Lo Coastal Engineering Branch. W. J. Herron, and R. L. Harris.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 38, p 651-675, 1967. 12 fig, 2

Descriptors: \*Bypasses, \*Waves
\*Coastal structures, \*Breakwaters, (Water), Littoral. Descriptors: \*California

Identifiers: Port Hueneme (Ca), \*Sand bypassing, Wave height, Diffraction patterns.

Port Hueneme Harbor, California, constructed in 1940, resulted in the average annual erosion of 1,200,000 cubic yards from the shoreline downcoast of the harbor. The cause was diversion by the north jetty of the harbor of littoral sand movement into the Hueneme canyon. A sand bypass system was established in 1960-61 by construction, one mile upcoast, of Channel Islands Harbor fronted by an offshore breakwater 2,300 feet in length and located on the 30-foot-depth contour. This breakwater serves a dual function of sheltering the harbor entrance and acting as a littoral sand trap. Three cycles of biennial littoral sand bypassing have been successfully completed sand oppassing have oeen successfully completed resulting in supply of 11,000,000 cubic yards of sand to the eroding shoreline at an average annual cost of \$0.40 per cubic yard, including annual maintenance and amortization of structures. Comparison of design of the structure to the impounding characteristics experienced during three bypass cycles indicates that the dimensions and

capacity of a sand trap formed by an offshore breakwater can be based upon the diffraction patterns of prevailing wave trains at the two ends of the structure and is independent of the depth and dimensions of the entrapment area. Rate of im-poundment is equal to the rate of littoral drift at Port Hueneme. (See also W74-03674) (Sinha-OFIS) W74-03694

EQUILIBRIUM FLOW AREAS OF TIDAL IN-LETS ON SANDY COASTS, California Univ., Berkeley, Coll. of Engineering.

In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 1, Part 2, Chap 39, p 676-686, 1967. 3 fig. 1 tab,

Descriptors: United States, \*Inlets (Waterways), \*Waves (Water), Jetties, \*Sedimentation, Flow, Stabilization, Surf, \*Littoral drift, Tides, Coastal structures.

Identifiers: Tidal prism, \*Tidal currents, \*Wave action, Bed load.

The data cited pertain to inlets in equilibrium under tidal currents on the mainland coasts of the United States. Conclusions are: (1) The equilibrium minimum flow area of an inlet, with or without jetties, is controlled by the tidal prism. A reduction of the tidal prism by sedimentation, vegetation, or artificial fill will reduce the flow area. (2) If the tidal area is connected to the sea through two or more inlets, closure of one or more of these channels will enlarge the flow area of the others. (3) Jetties not only stabilize the position of an inlet but also protect it against closure under wave action.

(4) Very small inlets can be kept open by tidal currents, if they are protected against strong surf and littoral drift. (5) The equilibrium flow area of an inlet depends to a minor extent, if at all, on bed material size. (6) Tractive force does not appear to provide a meaningful criterion for the equilibrium conditions of tidal inlets. (See also W74-03674) (Sinha-OEIS) W74-03695

SUSPENDED SEDIMENT IN A TIDAL ESTUA-

RY, Liverpool Univ. (England). Dept. of Civil Engineering. For primary bibliographic entry see Field 02L. W74-03696

DEPOSITIONAL BEHAVIOR OF FINE SEDI-MENT IN A TURBULENT FLUID MOTION, Massachusetts Inst. of Tech., Hydrodynamics Lab. For primary bibliographic entry see Field 02J. W74-03697

MATHEMATICAL SIMULATION OF BOTTOM SEDIMENT MOTION BY WAVES. National Research Council of Canada, Ottawa (Ontario). Hydraulics Section. For primary bibliographic entry see Field 02J. W74-03698

PROCEEDINGS OF TENTH CONFERENCE ON COASTAL ENGINEERING, TOKYO, JAPAN, SEPTEMBER, 1966, VOLUME II.

American Society of Civil Engineers, New York, Vol 2, Parts 3 and 4, p 793-1546, J. W. Johnson, Editor, 1967. Price: \$12.00 per 2 vols.

Descriptors: \*Coastal engineering, Structures, \*Sedimentation, \*Estuaries, Diffusion, River flow, Littoral drift, Salinity, Shore protection, Beach erosion, Bays, Harbors, Inlets (Water-

# **ENGINEERING WORKS—Field 08** Fisheries Engineering—Group 81

ways), Tidal effects, Ocean waves, Saline water intrusion, Tracers, Model studies, Conferences, \*Waves (Water). Identifiers: Flushing

This is the second of two volumes of papers which nns is the second of two volumes of papers which constitute the proceedings of the Tenth Conference on Coastal Engineering held in Tokyo, September 1966. It contains papers on studies on coastal structures and related problems and coastal engineering problems. (See W74-03674 and W74-03700 thru W74-03705) (Sinha-OEIS) W74-03699

SHORE PROTECTION ON THE COAST OF

Fisheries Agency, Tokyo (Japan). Fishing Port Div.

G. Seo, and T. Fukuchi.

O. Seo, and 1. Pusueni. In: Proceedings of Tenth Conference on Coastal Engineering, Tokyo, Japan, September 1966, American Society of Civil Engineers, New York, Vol 2, Part 3, Chap 67, p 1183-1200, 1967. 15 fig.

Descriptors: Coasts, \*Beach erosion, Bays, \*Waves (Water), \*Tides, \*Currents (Water), Shore protection.

Identifiers: Pacific Ocean, Yaizu Coast, \*Japan, Suruga Bay.

The history of beach erosion and the countermeasures against it extending over the last few centuries on the coast of 'YAIZU' Fishing Port are described. A study is included on the causes of erosion by analysing geographical, topographical and oceanographical conditions of the coastal area. (See also W74-03699) (Sinha-OEIS) W74-03700

HYDRAULIC SURVEY AND MODEL IN-VESTIGATION OF THE INNER RANA FJORD, Norges Tekniske Hoegskole, Trondheim. River and Harbor Lab.

For primary bibliographic entry see Field 02L. W74-03701

SALINITY DISTRIBUTION AND EFFECT OF FRESH WATER FLOWS IN THE HOOGHLY

Central Water and Power Research Station, Poona (India).

For primary bibliographic entry see Field 02L. W74-03702

STUDIES ON SALT WEDGE BY ULTRASONIC

METHOD, Hokkaido Univ., Sapporo (Japan). Dept. of En-

gineering Science. For primary bibliographic entry see Field 02L. W74-03703

PREDICTED FLUSHING TIMES AND POLLU-TION DISTRIBUTION IN THE COLUMBIA

Oregon State Univ., Corvallis. Dept. of Oceanog-

For primary bibliographic entry see Field 05B. W74-03704

PRELIMINARY RESULTS AND COMPARISON OF DYE TRACER STUDIES CONDUCTED IN HARBORS, ESTUARIES, AND COASTAL

Naval Oceanographic Office, Washington, D.C. For primary bibliographic entry see Field 05B. W74-03705

RESPONSE CHARACTERISTICS OF TOKYO BAY TO INCIDENT LONG WAVES, Central Research Inst. of Electric Power Industry, Tokyo (Japan).

For primary bibliographic entry see Field 02L.

DAMS AND BEACH-SAND SUPPLY IN SOUTHERN CALIFORNIA, California Univ., Santa Barbara. Dept. of Geolo-

gy. For primary bibliographic entry see Field 02J. W74-03708

MODELS PREDICT ENVIRONMENT. For primary bibliographic entry see Field 02L. W74-03713

# 8C. Hydraulic Machinery

COASTAL SAND MINING IN NORTHERN

CALIFORNIA, U.S.A.,
Army Coastal Engineering Research Center,
Washington, D.C.

Washington, D.C.
O.T. Magoon, J. C. Haugen, and R. L. Sloan.
Reprint No 16-73, Reprinted from Proceedings of
13th Coastal Engineering Conference, July 10-14,
1972, Vancouver, B. C., Canada: American
Society of Civil Engineers Publication, Chapter
87, p 1571-1597, 1972. 21 fig, 1 tab, 14 ref.

Descriptors: \*Sands, \*Beaches, \*California, \*Mining, Dredging, Aggregates, Coastal engineer-Identifiers: \*Sand mining.

The commercial mining of sand at coastal loca-tions along California has been a continuing activity at some sites, sporadic at others, and altogether discontinued at still other sites. This mining activi ty includes all methods of sand mining (dragline self-propelled bottom-dump scrapers, diesel shovels, etc.) and may be classified by littoral zone location as (1) mining from a beach foreshore or backshore area wetted by the normal tidal range, (2) mining within a river mouth or other estu upstream from the ocean but still within the tidal zone, and (3) mining from bluff or dune areas not wetted by the normal range of tides but still within the littoral system. Monterey Bay area has the highest concentration of mining activity. To the north, the area around Fort Bragg yields signifi-cant quantities to the commercial miner. Most of the remaining coastal sand mining activity is con-centrated in the San Francisco area. (Knapp-W74-03371

A DYNAMIC PROGRAMMING-SIMULATION A DYNAMIC PROGRAMMING-SIMULATION STRATEGY FOR THE CAPACITY EXPANSION OF HYDROELECTRIC POWER SYSTEMS, Stanford Univ., Calif. Dept. of Civil Engineering. J. Kuiper, and L. Ortolano. Water Resources Research, Vol 9, No 6, p 1497-1510, December 1973. 1 fig, 5 tab, 5 ref.

Descriptors: \*Water resources development, \*Hydroelectric power, \*Dynamic programming, \*Simulation analysis, Powerplants, Reservoirs, Storage capacity, Operating costs, Planning, River basins, Methodology, Mathematical models, basins, Methodo Systems analysis.

Identifiers: \*Capacity expansion, \*Cost minimization. Brazil.

Two approximate but very efficient, new techniques are presented which solve some major difficulties encountered with conventional power planning methods. Traditional means usually employ a detailed simulation model to study system operation, and engineering judgment to analyze al-ternatives. Such detailed simulation limits the number of alternatives possible to investigate, and the lack of a systematic procedure for considering alternatives, such as possible sequences of long-term power development, may hinder the making of economically optimum decisions. The capacity

expansion of a mixed hydrothermal power system expansion of a mixed hydrothermal power system is analyzed by means of dynamic programming to compare alternative sequences of power develop-ment and by means of a fast running, approximate simulation model to evaluate the operation of possible power system states in the dynamic programming model. Because the simulation of all gramming model. Because the simulation of all states in the dynamic programming model is too time consuming, only selected states are simulated, and these states are identified by using an iterative solution procedure. The resulting 'dynamic programming--simulation strategy' is applied to a preliminary planning of the expansion of a mixed hydrothermal power system in Brazil. The solution procedure is computationally efficient and leads to a substantial reduction in the estimated cost of a future sequence of power developmated cost of a future sequence of power development. (Bell-Cornell) W74-03470

CONVERSION SYSTEM FOR PROVIDING USE-FUL ENERGY FROM WATER SURFACE MO-

TION, D. T. Riches

U.S. Patent No 3,758,788, 4 p, 5 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 914, No 2, p 740, September 11, 1973.

Descriptors: \*Patents, \*Waves (Water), \*Ocean waves, \*Energy conversion, Surfaces, Hydraulic structures.

Identifiers: Water surfaces, Buoyant structures

Wave motion may be converted to energy by the method presented. A device is described for con-verting random motion at the surface of a body of verting random motion at the surface of a water to a usable form of energy so as to compress fluid, displace fluid or provided electrical energy. Hund, displace rund or provide electrical energy. Buoyant structures are provided defining pairs of opposed surfaces affixed together by pivotal structures with energy means, e.g. bellows, held spaced-apart from the pivot device. The bellows are actuated with displacements between the buoyant structures, to develop positive fluid presures to accomplish various operations. (Sinha OEIS) W74-03669

#### 8D. Soil Mechanics

COASTAL SAND MINING IN NORTHERN CALIFORNIA, U.S.A.,
Army Coastal Engineering Research Center,
Washington, D.C. For primary bibliographic entry see Field 08C. W74-03371

#### 8F. Concrete

HYDRAULIC FRACTURING AS A TOOL FOR DISPOSAL OF WASTES IN SHALE Geological Survey, Washington, D.C. For primary bibliographic entry see Field 05E. W74-03231

#### 8H. Rapid Excavation

STUDIES OF IMPULSIVELY--GENERATED WATER WAVES.
Hawaii Univ., Honolulu. Dept. of Civil Engineer-For primary bibliographic entry see Field 08B. W74-03689

#### 8I. Fisheries Engineering

REARING BAIT FISHES IN THE ROCKY MOUNTAIN STATES, Colorado State Univ., Fort Collins. S. A. Flickinger.

#### Field 08-ENGINEERING WORKS

#### Group 81—Fisheries Engineering

Available from NTIS, Springfield, Va. 22151 as COM-72-11311 - Price \$3.00 printed copy; \$1.45 microfiche. Project Completion Rep Colorado Dept of Natural Resources and NOAA, National Marine Fisheries Service, March 1971.

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, Fish reproduction, Fish management, Ecology, Fish populations, Baits, Fish farming, Aquatic habitats, Fish diseases, Fish harvest. Identifiers: \*Fathead minnows.

Current literature related to distribution of the fathead minnow in Colorado was reviewed. Past studies have covered only distribution in generally local situations, general life history characteristics, and points for further study. The fathead minnow is found in all five of the major river drainages of Colorado, although this species is native only to eastern slope drainages. The community containing the fathead minnow is typical of species normally found in slow or standing water. There were no specific associations which could not be attributed to habitat preferences of the individual species. Consistent associations of other species with the fathead minnow were noted only in cases involving ubiquitous species. In general, the community lacks definite structure, but in-terpretation is hampered by lack of information on the position and role of the different species in the ecosystem. (See W74-03262 thru W74-03270) (Knapp-USGS) W74-03261

DETERMINE THE PRESENT VOLUME AND VALUE OF BAIT FISH SALES BY SPECIES IN COLORADO AND ADJACENT MOUNTAIN STATES, Colorado State Univ., Fort Collins.

S. A. Flickinger.

In: Rearing Bait Fishes in the Rocky Mountain States, Project 6-2-D-11, p 1-24, 1971. 33 ref, ap-

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, \*Fish farming, Fish management, Baits.

Bait minnow culture was studied by visiting the Fish Farming Experimental Station, Stuttgart, Ar-kansas, Bureau of Sport Fisheries and Wildlife. Colorado bait fish dealers were interviewed. A total of 25 active and four inactive retailers and two active wholesalers were contacted. available literature sources were reviewed. The sale of bait minnows in Colorado at present is not a big business. Further development of the bait min now business is dependent on greater utilization of existing warm water fisheries resources and full exploitation of proposed structures that will provide warm-water habitat. (See also W74-03261) (Knapp-USGS) W74-03262

DISTRIBUTION AND COMMUNITY RELA-TIONSHIPS OF THE FATHEAD MINNOW (PIMEPHALES PROMELAS) IN COLORADO AND ADJACENT MOUNTAIN STATES,

Colorado State Univ., Fort Collins A. K. Andrews

In: Rearing Bait Fishes in the Rocky Mountain States, Project 6-2-D-2, p 25-56, 1971. 2 fig, 13 tab, 57 ref, append.

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, Fish reproduction, Fish management, Ecology, Fish populations, Baits, Fish farming, Aquatic habitats, Fish diseases, Fish harvest. Identifiers: \*Fathead minnows.

Current literature related to distribution of the fathead minnow in Colorado was reviewed. Past studies have covered only distribution in generally local situations, general life history characteristics, and points for further study. The fathead minnow is found in all five of the major river

drainages of Colorado, although this species is native only to eastern slope drainages. The community containing the fathead minnow is typical of species normally found in slow or standing water. There were no specific associations which could not be attributed to habitat preferences of the individual species. Consistent associations of other species with the fathead minnow were noted only in cases involving ubiquitous species. In general, the community lacks definite structure, but interpretation is hampered by lack of information on the position and role of the different species in the ecosystem. (See also W74-03261) (Knapp-USGS) W74-03263

CONSTRUCTION OF EXPERIMENTAL BAIT FISH CULTURE PONDS, Colorado State Univ., Fort Collins.

S. A. Flickinger.

In: Rearing Bait Fishes in the Rocky Mountain States, Project 6-2-D-3, p 57-58, 1971.

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, \*Fish farming, Fish management, Baits.

Since utilization of a variety of farm ponds scattered throughout different areas was undesirable for studying bait fish farming in Colorado, it was necessary to construct 11 experimental ponds in one location. Additional construction to comple-ment the pond facility included two cement holding tanks and a small storage shed. The use of a variety of farm ponds scattered throughout dif-ferent areas would introduce too many variables to adequately analyze the results. Surface water for supplying farm ponds in Colorado is generally in-sufficient with tremendous fluctuations. Farm ponds are typically not capable of being drained. (See also W74-03261) (Knapp-USGS)

GROWTH AND MORTALITY OF THE FATHEAD MINNOW AS RELATED TO POPULATION DENSITY IN PRODUCTION PONDS,

Colorado State Univ., Fort Collins S. A. Flickinger.

In: Rearing Bait Fishes in the Rocky Mountain States, Subproject 6-2-D-4, p 59-61, 1971.

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, \*Fish farming, Fish management, Baits.

Individual spawning sites were constructed and female fathead minnows for use as brood fish were secured for a study of growing fathead minnows for bait in Colorado. Weekly determinations of water temperatures and dissolved oxygen levels were made. A complete harvest was made immediately after ice melt. The effects of population density, selective harvesting, and winter mortality on yields and survival were tested. (See also W74-03261) (Knapp-USGS)

LAKE DISTRIBUTION IN COLORADO AND COMMUNITY RELATIONSHIPS OF THE FATHEAD MINNOW IN TWO LAKE POPULA-TIONS, Colorado State Univ., Fort Collins.

S. A. Flickinger. In: Rearing Bait Fishes in the Rocky Mountain States, Subproject 6-2-D-5, p 62-69, 1971. 2 fig, 2

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, Fish reproduction, Fish management, Ecology, Fish populations, Baits, Fish farming, Aquatic habitats, Fish diseases, Fish harvest. Identifiers: \*Fathead minnows.

The availability of spawning sites appears to be a limiting factor in the warm water population of fathead minnows. The habitats in which fathead minnows were found in the greatest abundance were shallow (10 feet in depth or less), having dense growths of Elodea canadensis with some Potamogeton richardsonius, and characteristically a substrate of granite overlain with 1 to 2 feet of muck and detritus. The aquatic vegetation was generally confined to water depths of 10 feet and less. The greatest amount of spawning activity was recorded between June 16 and July 21. Generally, the immature fish ate a higher percentage of plant material than the adult fish. At the beginning of the sampling the adults consumed nearly 100% animal material. Gradually this trend reversed until by the last of July the fish were consuming nearly 100% vegetable material. (See also W74-03261) (Knapp-USGS)
W74-03266

SELECTION OF THE OPTIMUM BROOD FISH DENSITY AND SEX RATIOS OF THE FATHEAD MINNOW (PIMEPHALES PROMELAS) UNDER PRESCRIBED SPAWNING CONDITIONS, Colorado State Univ., Fort Collins.

S. A. Flickinger.

In: Rearing Bait Fisheries in the Rocky Mountain States, Subproject 6-2-D-6, p 70-79, 1971. 1 fig, 4

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, Fish reproduction, Fish management, Ecology, Fish populations, Baits, Fish farming, Aquatic habitats, Fish diseases, Fish harvest. Identifiers: \*Fathead minnows.

To increase the production of fathead minnow fry, it was hypothesized that either the brood fish population density could be increased, the sex ratio could be altered, or more intensive spawning techniques could be developed. The first two alternatives were studied simultaneously by stocking four population densities in combination with sex ratios. The lowest population density (25,000 fish per surface acre) was by far the most productive density; there was a slight superiority optimum combination was 32,300 fish per surface acre with a sex ratio of 7.1 females to 1 male. The predicted optimum combination was 32,300 fish per surface acre with a sex ratio of 7.1 females to 1 male giving a maximum production of 3,281,320 fry. Fa minnows will spawn at any depth up to 5 feet. Spawning boards can be placed without reference to the pond bottom. When spawning space is not limited, territorial conflict is not sufficient to reduce spawning activity. (See also W74-03261) (Knapp-USGS) W74-03267

THE LIFE HISTORY OF THE FATHEAD MIN-NOW (PIMEPHALES PROMELAS) IN COLORADO AND ADJACENT MOUNTAIN STATES, Colorado State Univ., Fort Collins.

A. K. Andrews

In: Rearing Bait Fishes in the Rocky Mountain States, Subproject 6-2-D-7, p 80-94, 1971. 3 fig, 6

Descriptors: \*Minnows, \*Colorado, \*Bait fishing, Fish reproduction, Fish management, Ecology, Fish populations, Baits, Fish farming, Aquatic habitats, Fish diseases, Fish harvest. Identifiers: \*Fathead minnows

Day length is the major controlling factor in the initiation of spawning activity of fathead minnows. There are no reliable means of estimating potential egg production per female. Estimated reproduc-tive potential is sufficient to account for differences in the estimated population of the two study lakes. There were no significant differences in the sizes of male, female, and immature fish from the two populations. The average life span of this species is 2-3 years. The existence of subpopulations and movement within a particular lake is dependent on the presence of desirable habitat. The coldwater environment has discontinuous

#### Preparation of Reviews-Group 10F

favorable habitat and the fish established stable subpopulations during the summer months while the converse was true for the fish representing the warm water environment. Fathead minnows select animal material early in the spring and gradually shift to a herbivorous diet as the year progresses. (See also W74-03261) (Knapp-USGS) W74-03268

DISTRIBUTION IN COLORADO, COMMUNITY RELATIONSHIPS, AND PRELIMINARY LIFE HISTORY OF THE WHITE SUCKER (CATOSTOMUS COMMERSONI)--JULY 1, 1968

TO JUNE 30, 1969, Colorado State Univ., Fort Collins.

M. R. Carpenter.
In: Rearing Bait Fishes in the Rocky Mountain States, Subproject 6-2-D-8, p 95-102, 1971. 51 ref.

Descriptors: \*Suckers, \*Baits, \*Colorado, \*Fish farming, Ecology, Fish populations, Aquatic habitats, Fish behavior, Fish diseases, Fish harvest, Fish reproduction, Bait fishing. Identifiers: White sucker.

The white sucker (Catostomus commersoni) is being used as a bait fish in many states. Colorado has much of its fishing waters impounded in reservoirs, and with the present trend more of Colorado's water will be impounded. White suckers would make a good bait fish for fishing in impounded waters. Suckers generally spawn in streams, but they also spawn in lakes. Suckers spawn in well aerated riffle or shoal areas in the spring and summer when the water temperatures range from 50 deg to 65 deg. Suckers are noted for range from 50 deg to 50 deg. Suckers are noted to their spring spawning migrations up tributary streams during the spring. Predation by game-fish on suckers is restricted to the fry stage. The white sucker is distributed from Georgia to Hudson Bay, west to Colorado and north to the Northwest Territories and west to the Farser and Skeena River drainages of British Columbia. In Colorado it is in the South Platte, North Platte, Laramie, Colorado, Gunnison, and Arkansas River drainages. (See also W74-03261) (Knapp-USGS) W74-03269

DISTRIBUTION IN COLORADO, COMMUNITY RELATIONSHIPS, AND PRELIMINARY LIFE HISTORY OF THE WHITE SUCKER (CATOSTOMUS COMMERSONI)-JULY 1, 1969

TO JANUARY 31, 1970, Colorado State Univ., Fort Collins.

M. R. Carpenter.

In: Rearing Bait Fishes in the Rocky Mountain States, Subproject 6-2-D-8, p 105-129, 1971. 2 fig, 4 tab, 58 ref.

Descriptors: \*Suckers, \*Baits, \*Colorado, \*Fish Descriptors: Suckers, "Batts, "Colorado, "Fish farming, Ecology, Fish populations, Aquatic habitats, Fish behavior, Fish diseases, Fish harvest, Fish reproduction, Bait fishing.

Identifiers: "White sucker.

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THE FEEDING ECOLOGY OF THE ROCK GREENLING, HEXAGRAMMOS LAGOCEPHA LUS. IN THE INSHORE WATERS OF AMCHIT-KA ISLAND, ALASKA, Washington Univ., Seattle. Coll. of Fisheries For primary bibliographic entry see Field 02I. W74-03505

WATER CIRCULATION SYSTEM FOR FRESH WATER FISH HUSBANDRY. Marine Protein Corp., New York. (Assignee).

For primary bibliographic entry see Field 05D. W74-03659

TROPICAL BAY IN DANGER, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla. For primary bibliographic entry see Field 06G. W74-03716

FARMING THE SEA, Rosenstiel School of Marine and Atmospheric Science, Miami, Fla. C. P. Idvll. Sea Frontiers, Vol 18, No 2, p 107-116, March-April 1972. 8 photo.

Descriptors: \*Aquatic animals, \*Brood stock, \*Breeding, \*Fish hatcheries, \*Aquiculture, Aquatic habitats, Fish, Fisheries, Fish management, Oysters, Spawning, Fish farming, Shellfish farming, Shrimp, Lobsters, Mussels, Commercial fishing. Identifiers: Aquatic farming.

Although hunting on land as a method of obtaining food a thousand years ago was abandoned in favor of farming, man still obtains most of his seafood from hunting. But aquatic farming is becoming more common, particularly in land scarce Asia.

Many species of fish are unmanageable for farm-For example, tuna need large quantities of food and a great deal of ocean for maneuvering. Despite the unrealistic concepts of enclosing the deeper parts of the ocean, there are still tremendous amounts of marshland available. The ultimate aim of fish farming should be to control the animal during every phase of its life. Brood stock should be maintained in captivity and spawning controlled. Natural selection should be possible, so that brood animals can be chosen for size, flavor, rapid growth, resistance to disease and other desireable characteristics. While not providing some of the above qualities, some of the species currently being developed by sea farmers are oysters, shrimp, eels, yellowtail fish and mussels. In view of the tremendous strides in aquifarming made in a relatively short time, rapidly improving skills should soon increase its trivial contribution of the past. (Ritchie-Florida) W74-03717

### 10. SCIENTIFIC AND TECHNICAL INFORMATION

### 10C. Secondary Publication And Distribution

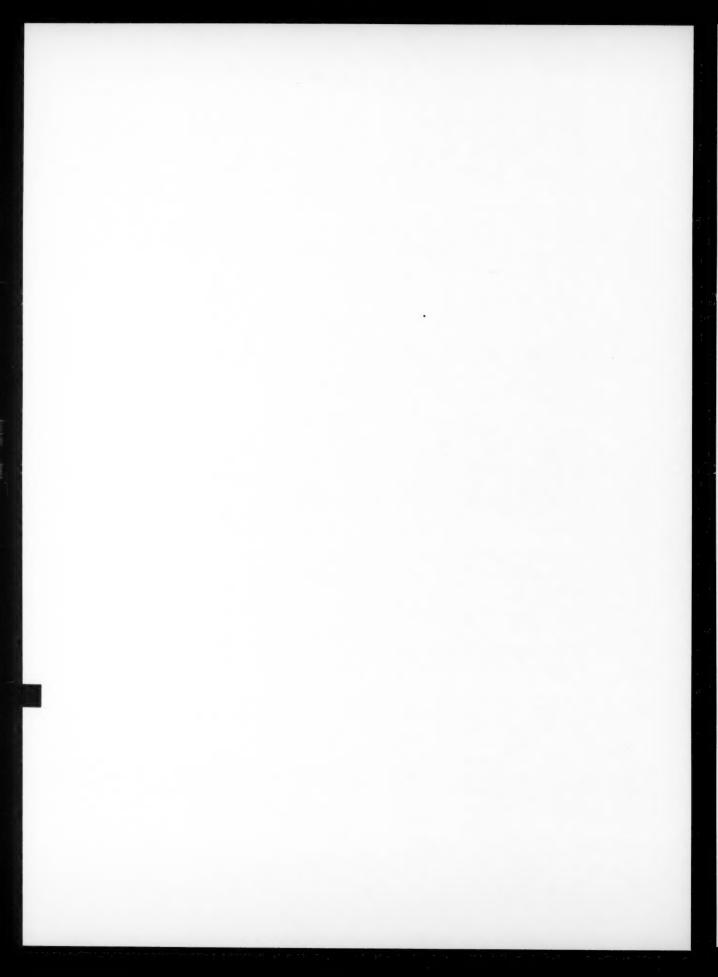
WATER LAW AND ITS RELATIONSHIP TO ENVIRONMENTAL QUALITY: A BIBLIOG-RAPHY OF SOURCE MATERIAL, Colorado State Univ., Ft. Collins. Dept. of Economics. or primary bibliographic entry see Field 05G. W74-03322

INTERNATIONAL ENVIRONMENTAL BIBLIOGRAPHIES, SERIES I: LEGISLATIVE AND REGULATORY REPORTS. Environmental Protection Agency, Washington, D.C. Office of International Activities. For primary bibliographic entry see Field 05G. W74-03383

### 10F. Preparation of Reviews

EFFECTS OF RESIDUAL CHLORINE ON AQUATIC LIFE, National Water Quality Lab., Duluth, Minn. For primary bibliographic entry see Field 05C. W74-03298

ARTIFICIAL RECHARGE-STATE OF THE ART, Geological Survey, Lubbock, Tex. For primary bibliographic entry see Field 04B. W74-03354



| 2 4 5-T   | AERATION                                       | ALASKA   |
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| Photodecomposition of 2,4,5-Trichlorophenox-      | Power Input for the Surface Aerator in Waste   | Some Arctic Limnology and the Hibernation of   |
| yacetic Acid (2,4,5-T) in Water,                  | Water Treatment Plants (Prikon povrchoveho     | Invertebrates and some Fishes in Sub-Zero      |
| W74-03585 5B                                      | aeracniho michadla pro cisteni odpadnich vod), | Temperatures,                                  |
|   | W74-03555 5D                                   | W74-03275 2H                                   |
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| Germanium Incorporation into the Silica of        | Big Plant Will Treat Waste With Pure Oxygen.   | The Feeding Ecology of the Rock Greenling,     |
| Diatom Cell Walls,                                | W74-03638 5D                                   | Hexagrammos lagocephalus, in the Inshore       |
| W74-03280 5C                                      |  | Waters of Amchitka Island, Alaska,             |
|   | Phosphorous Removal from Wastewater,           | W74-03505 2I                                   |
| Half-Saturation Constants for Uptake of           | W74-03667 5D                                   |  |
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| W74-03299 5C                                      | AERATORS                                       | Organic Nutrient Factors Effecting Algal       |
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| W 74-03030  | aeracniho michadla pro cisteni odpadnich vod), | The Coastal Shoals of Western Cuba and Their   |
| ACID-BASE EQUILIBRIUM                             | W74-03555 5D                                   | Deposits.                                      |
| Thermodynamics of Acid-Base Equilibria. m'        |  | W74-03443 2L                                   |
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| ACIDS   |  | W74-03595 5C                                   |
| Case History of Subsurface Waste Injection of     | AEROBIC BACTERIA                               | Control of Assetic Mant Life                   |
|   | Parabiotic Growth Characteristics of Selected  | Control of Aquatic Plant Life,                 |
| an Industrial Organic Waste,<br>W74-03245 5E      |  | W74-03653 4A                                   |
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| Comparison of Field and Sigma-Inductive           | W74-03203 5C                                   | Controlling Algae with 5- (5 Barbiturilidene)- |
|   | AEROBIC CONDITIONS                             | Rhodanine,                                     |
| Models for the Transmission of Nonconjuga-        |  | W74-03665 4A                                   |
| tive Substituent Effects. The 2,6-Spiro (3,3)     | An Aerophilous Diatom Community from           |  |
| Heptyl System,                                    | Hocking County, Ohio,                          | Recycling Wastes for Mariculture,              |
| W74-03737 2K                                      | W74-03318 5A                                   | W74-03714 5G                                   |
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| ACTIVATED CARBON                                  | AEROBIC TREATMENT                              | ALGAL BIOCENOSES                               |
| Iodine Treated Activated Carbon and Process       | Big Plant Will Treat Waste With Pure Oxygen.   | In Situ Experimental Investigations of the     |
| of Treating Contaminated Water Therewith,         | W74-03638 5D                                   | Biomass Production of Micro-Algae and of       |
| W74-03651 5D                                      |  | Natural Algal Biocoenoses in Flowing Waters,   |
|   | AESTHETICS                                     | (In German),                                   |
| Method of Treating Oil-Containing Con-            | Water Law and Its Relationship to Environ-     | W74-03598 5C                                   |
| taminated Drainage,                               |  | W 14-03330                                     |
| W74-03660 5D                                      | mental Quality: A Bibliography of Source       | ALGAL CONTROL                                  |
|   | Material,                                      | Controlling Algae with 5- (5 Barbiturilidene)- |
| ACTIVATED SLUDGE                                  | W74-03322 5G                                   |  |
| Oxygen Activated Sludge Wastewater Treat-         |  | Rhodanine,                                     |
| ment Systems: Design Criteria and Operating       | AGRICULTURAL CHEMICALS                         | W74-03665 4A                                   |
| Experience,                                       | Kings County Economic Community Develop-       | ALCAL CROWTH                                   |
| W74-03496 5D                                      | ment Association V. Hardin (Payment of Farm    | ALGAL GROWTH                                   |
|   | Subsidies Do Not Require Nepa Approval).       | Organic Nutrient Factors Effecting Algal       |
| ADENOSINE TRIPHOSPHATE                            | W74-03417 6E                                   | Growths,                                       |
| Quantitative Extraction of Adenosine              |  | W74-03326 5C                                   |
| Triphosphate From Cultivable and Host-Grown       | AGRICULTURE                                    |  |
| Microbes: Calculation of Adenosine                | Agricultural Reconnaissance Supplement to the  | ALGICIDES                                      |
| Triphosphate Pools,                               | Mill Creek Development Project.                | Control of Aquatic Plant Life,                 |
|   | W74-03488 6D                                   | W74-03653 4A                                   |
| W74-03570 5A                                      | OD   |  |
| ADMINISTRATION                                    | AIR CUSHION                                    | Controlling Algae with 5- (5 Barbiturilidene)- |
| Investigation of the Public and Private Interests | Shock Pressure of Breaking Wave,               | Rhodanine,                                     |
| in the Chesapeake Bay Area,                       |  | W74-03665 4A                                   |
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| H /4-03332 OB                                     | AIRPORTS                                       | ALLUVIUM                                       |
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| W74-03504 5G                                      | Establishment of Airports on Public Waters     | in Alluvium Near Barstow, California,          |
| W 74-03304 3G                                     | and Reclaimed Lands.                           | W74-03228 5E                                   |
| Criminal OffensesPollution).                      | W74-03731 6E                                   |  |
| -   |  | ALTERATION OF FLOW                             |
| W74-03722 6E                                      | AIRY WAVES                                     | Howe V. Di Pierro Manufacturing Co., Inc.      |
| MunicipalitiesLake Authorities.                   | Laminar Damping of Oscillatory Waves Due to    | (Appeal by Defendants from an Order Enjoin-    |
| W74-03734 6E                                      | Bottom Friction,                               | ing Them from Flooding Plaintiff's Property).  |
| # /4-03/34 OE                                     | W74-03679 8B                                   | W74-03402 6E                                   |
| ADMINISTRATIVE AGENCIES                           |  | 0E   |
| Public Works for Water and Power Develop-         | ALABAMA  | ALUMINUM                                       |
| ment and Atomic Energy Commission Ap-             | Subsurface Disposal of Liquid Industrial       | Removal of Phosphate from Waste Water by       |
| propriation Bill, 1974, Parts 1 and 2.            | Wastes in Alabama-A Current Status Report,     | Aluminum and Iron, Phase III,                  |
| W74-03710 6E                                      | W74-03227 5E                                   | W74-03208 5D                                   |
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| Sewerage Districts and Sewerage District          | Front Owner to Remove Boathouse from Lake      | tion (pH i effektivnost' ochistki stochnykh    |
| Boards.   | Shore).  | vod),  |
| W74-03411 6E                                      | W74-03408 6E                                   | W74-03556 5D                                   |
|   | OE   |  |

#### AMMONIA

| AMMONIA  | APHANOTHECE   | AQUICLUDES  |
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| Half-Saturation Constants for Uptake of  | Nitrogen Fixation by the Unicellular Blue-  | Site Investigations for a Bedded-Salt Pilot Plant |
| Nitrate and Ammonia By Reservoir Plankton,   | Green Alga Aphanothece,   | in Permian Basin,                                 |
| W74-03299 5C   | W74-03278 5C  | W74-03249 5E                                      |
|  | ACTUATED ANDMALD  | A OLUCY II TUDE                                   |
| Water Circulation System for Fresh Water Fish  | AQUATIC ANIMALS   | AQUICULTURE                                       |
| Husbandry,   | Farming the Sea,<br>W74-03717 8I  | Farming the Sea,                                  |
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| Effect of Phosphate and Chloride Salts on Am-  | Control of Aquatic Plant Life,  | W74-03732 6E                                      |
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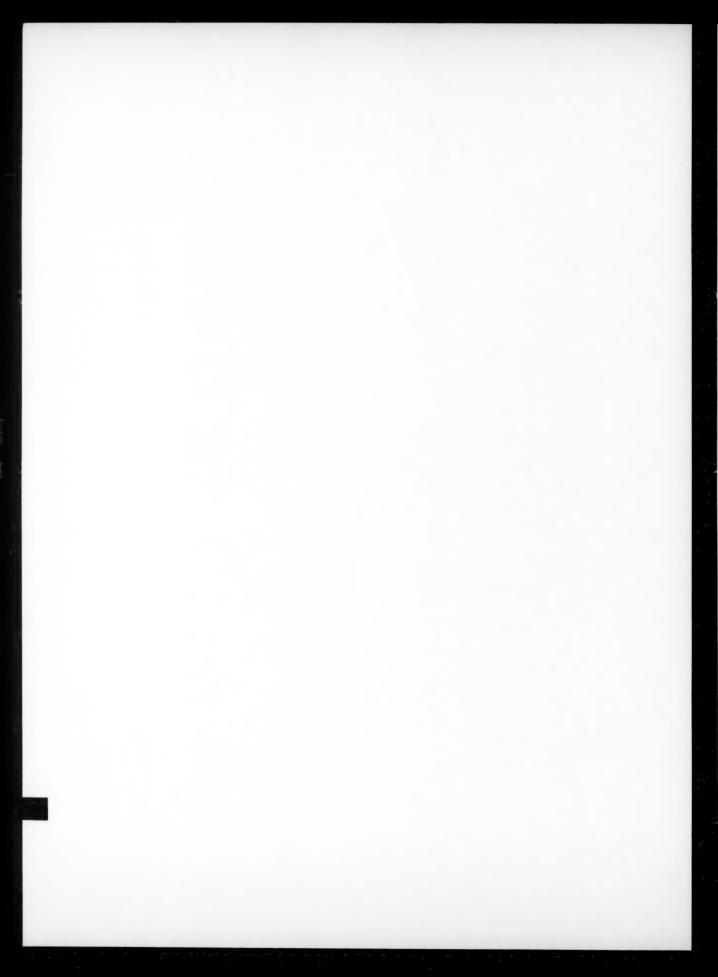
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| W74-03671         SD           W74-03672         SG           W74-03673         2E           W74-03674         8B           W74-03676         8B           W74-03677         8B           W74-03678         8B           W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03699         2L           W74-03690         2L           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03697         2L           W74-03698         2J           W74-03700         8B           W74-03701         2L           W74-03702         2L           W74-03703         2L <th></th> <th>-</th>  |             | -   |
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| W74-03673         2E           W74-03675         8B           W74-03675         8B           W74-03677         8B           W74-03679         8B           W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03699         2L           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         2B           W74-03695         8B           W74-03699         2L           W74-03699         8B           W74-03699         8B           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L <td></td> <td></td>   |             |     |
| W74-03674         8B           W74-03675         8B           W74-03676         8B           W74-03677         8B           W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03684         8B           W74-03688         8B           W74-03688         8B           W74-03689         2L           W74-03690         2L           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03697         2J           W74-03698         8B           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         2L <td></td> <td></td>   |             |     |
| W74-03675         8B           W74-036778         8B           W74-036779         8B           W74-03681         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03684         8B           W74-03685         8B           W74-036868         8B           W74-03687         8B           W74-03688         8B           W74-03698         2L           W74-03699         2L           W74-03690         2L           W74-03691         2L           W74-03692         2J           W74-03703         2L           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L     <  |             | 2E  |
| W74-03676         8B           W74-036778         8B           W74-03678         8B           W74-03679         8B           W74-03681         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03684         8B           W74-03685         8B           W74-03688         8B           W74-03689         8B           W74-03690         2L           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         2L           W74-03695         8B           W74-03696         2L           W74-03697         2J           W74-03698         2J           W74-03699         8B           W74-03699         8B           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L <td></td> <td>8B</td>  |             | 8B  |
| W74-03677         8B           W74-03679         8B           W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03685         8B           W74-036867         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L <td>W74-03675</td> <td>8B</td>   | W74-03675   | 8B  |
| W74-03677         8B           W74-03679         8B           W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03685         8B           W74-036867         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L <td>W74-03676</td> <td>8B</td>   | W74-03676   | 8B  |
| W74-03678         8B           W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03683         8B           W74-03684         8B           W74-03688         8B           W74-03688         8B           W74-03688         8B           W74-03689         8B           W74-03690         2L           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         2L           W74-03706         2L           W74-03707         2L           W74-03708         2J <td>W74_03677</td> <td>8B</td>  | W74_03677   | 8B  |
| W74-03679         8B           W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         8B           W74-03696         2L           W74-03697         2J           W74-03698         2J           W74-03699         8B           W74-03699         2J           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03711         5C <td>W74-03678</td> <td>8B</td>  | W74-03678   | 8B  |
| W74-03680         8B           W74-03681         8B           W74-03682         8B           W74-03683         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         8B           W74-03696         2L           W74-03699         2J           W74-03699         2J           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03700         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J <td>W74-03670</td> <td></td>  | W74-03670   |     |
| W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03698         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03709         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C <td>W74-03690</td> <td></td>  | W74-03690   |     |
| W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03698         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03709         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C <td>W74 03681</td> <td></td>  | W74 03681   |     |
| W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03698         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03709         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C <td>W/4-03081</td> <td></td>  | W/4-03081   |     |
| W74-03684         8B           W74-03685         8B           W74-03686         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03699         2L           W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03698         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03699         2L           W74-03709         2L           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C <td>W /4-03082</td> <td></td>   | W /4-03082  |     |
| W74-03688         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03691         2L           W74-03692         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03697         2L           W74-03698         2J           W74-03699         8B           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03711         5C           W74-03712         5C           W74-03713         5C           W74-03714         5G           W74-03715         5C           W74-03716         6G <td>W74-03683</td> <td></td>  | W74-03683   |     |
| W74-03688         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03691         2L           W74-03692         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03697         2L           W74-03698         2J           W74-03699         8B           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03711         5C           W74-03712         5C           W74-03713         5C           W74-03714         5G           W74-03715         5C           W74-03716         6G <td>W74-03684</td> <td></td>  | W74-03684   |     |
| W74-03688         8B           W74-03687         8B           W74-03688         8B           W74-03689         8B           W74-03691         2L           W74-03692         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03697         2L           W74-03698         2J           W74-03699         8B           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03711         5C           W74-03712         5C           W74-03713         5C           W74-03714         5G           W74-03715         5C           W74-03716         6G <td>W74-03685</td> <td></td>  | W74-03685   |     |
| W74-03688         8B           W74-03689         8B           W74-03690         2L           W74-03691         2L           W74-03692         2L           W74-03693         3L           W74-03694         8B           W74-03695         8B           W74-036969         2L           W74-03699         8B           W74-03699         8B           W74-03699         8B           W74-03700         8B           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         2L           W74-03714         5G           W74-03715         5G           W74-03716         6G <td>W74-03686</td> <td></td>   | W74-03686   |     |
| W74-03688         8B           W74-03689         8B           W74-03690         2L           W74-03691         2L           W74-03692         2L           W74-03693         3L           W74-03694         8B           W74-03695         8B           W74-036969         2L           W74-03699         8B           W74-03699         8B           W74-03699         8B           W74-03700         8B           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         2L           W74-03714         5G           W74-03715         5G           W74-03716         6G <td>W74-03687</td> <td></td>   | W74-03687   |     |
| W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03699         8B           W74-03699         8B           W74-03700         8B           W74-03702         2L           W74-03703         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03700         6E           W74-03710         6E           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         6G           W74-03714         5G           W74-03715         6G           W74-03716         6G           W74-03717         8I           W74-03718         6G <td>W74-03688</td> <td></td>  | W74-03688   |     |
| W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03699         8B           W74-03699         8B           W74-03700         8B           W74-03702         2L           W74-03703         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03700         6E           W74-03710         6E           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         6G           W74-03714         5G           W74-03715         6G           W74-03716         6G           W74-03717         8I           W74-03718         6G <td>W74-03689</td> <td></td>  | W74-03689   |     |
| W74-03691         2L           W74-03692         2L           W74-03693         2L           W74-03693         2L           W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03699         8B           W74-03699         8B           W74-03700         8B           W74-03702         2L           W74-03703         2L           W74-03705         5B           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03700         6E           W74-03710         6E           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         6G           W74-03714         5G           W74-03715         6G           W74-03716         6G           W74-03717         8I           W74-03718         6G <td>W74-03690</td> <td>2L</td>  | W74-03690   | 2L  |
| W74-03692         2L           W74-03693         2L           W74-03694         8B           W74-03695         8B           W74-03696         2L           W74-03697         2J           W74-03698         2J           W74-03700         8B           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         2L           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         5C           W74-03714         5G           W74-03715         6G           W74-03716         6G           W74-03717         8I           W74-03718         6G           W74-03719         5C           W74-03710         6G <td>W74-03691</td> <td>2L</td>  | W74-03691   | 2L  |
| W74-03694 8B W74-03695 8B W74-03696 2L W74-03698 2J W74-03698 2J W74-03698 2J W74-03701 2L W74-03701 2L W74-03701 2L W74-03703 2L W74-03703 2L W74-03705 5B W74-03706 2L W74-03706 2L W74-03707 2L W74-03708 2J W74-03708 2J W74-03710 6E W74-03711 5C W74-03711 5C W74-03711 5C W74-03712 5C W74-03713 2L W74-03714 6G W74-03715 6G W74-03716 6G W74-03717 5C W74-03718 6G W74-03718 6G W74-03718 6E W74-03726 6E W74-03726 6E W74-03726 6E W74-03727 6E W74-03728 6E W74-03729 6G W74-03729 6G W74-03720 6E W74-03720 6E W74-03720 6E W74-03720 6E W74-03721 6E W74-03721 6E W74-03722 6E W74-03723 6E W74-03724 6E W74-03725 6E W74-03726 6E W74-03727 6E W74-03728 6E W74-03729 6G W74-03731 6E W74-03731 6E W74-03731 6E W74-03732 6E W74-03733 6E W74-03734 6E W74-03735 6E W74-03736 6E W74-03736 6E W74-03737  6E W74-03737  6E W74-03738  6E W74-03738  6E W74-03741 1B W74-03742 6B W74-03744 6B W74-03745 6B  | W74-03692   | 2I. |
| W74-03694         8B           W74-03695         2L           W74-03696         2L           W74-03699         8B           W74-03699         8B           W74-03699         8B           W74-03700         8B           W74-03701         2L           W74-03702         2L           W74-03703         2L           W74-03704         5B           W74-03705         2L           W74-03706         2L           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03709         2J           W74-03710         6E           W74-03711         5G           W74-03712         5C           W74-03713         2L           W74-03714         5G           W74-03715         6G           W74-03716         6G           W74-03717         8I           W74-03718         6G           W74-03719         5C           W74-03719         5C           W74-03720         6G           W74-03721         2D           W74-03722         6E <td>W74-03693</td> <td></td>  | W74-03693   |     |
| W74-03695         8B           W74-03696         2L           W74-03697         2J           W74-03698         2J           W74-03700         8B           W74-03701         2L           W74-03702         2L           W74-03703         5B           W74-03704         5B           W74-03705         5B           W74-03707         2L           W74-03708         2J           W74-03709         2J           W74-03710         6E           W74-03711         5C           W74-03712         5C           W74-03713         5C           W74-03714         5G           W74-03715         5C           W74-03716         6G           W74-03717         8G           W74-03718         6G           W74-03719         5C           W74-03719         5C           W74-03719         5C           W74-03720         6E           W74-03721         2D           W74-03722         6E           W74-03723         6E           W74-03724         6E           W74-03725         6E <td></td> <td></td>   |             |     |
| W74-03698 2J W74-03698 2J W74-03698 2J W74-03700 8B W74-03701 2L W74-03702 2L W74-03703 2L W74-03705 5B W74-03706 2L W74-03706 2L W74-03708 2J W74-03708 2J W74-03709 2J W74-03710 6E W74-03711 5G W74-03711 5G W74-03713 2L W74-03715 5G W74-03716 6G W74-03717 8I W74-03718 6G W74-03718 6G W74-03719 5C W74-03720 6G W74-03720 6G W74-03720 6E W74-03730 6E   | W74_03695   |     |
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# CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

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- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agency.
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.

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